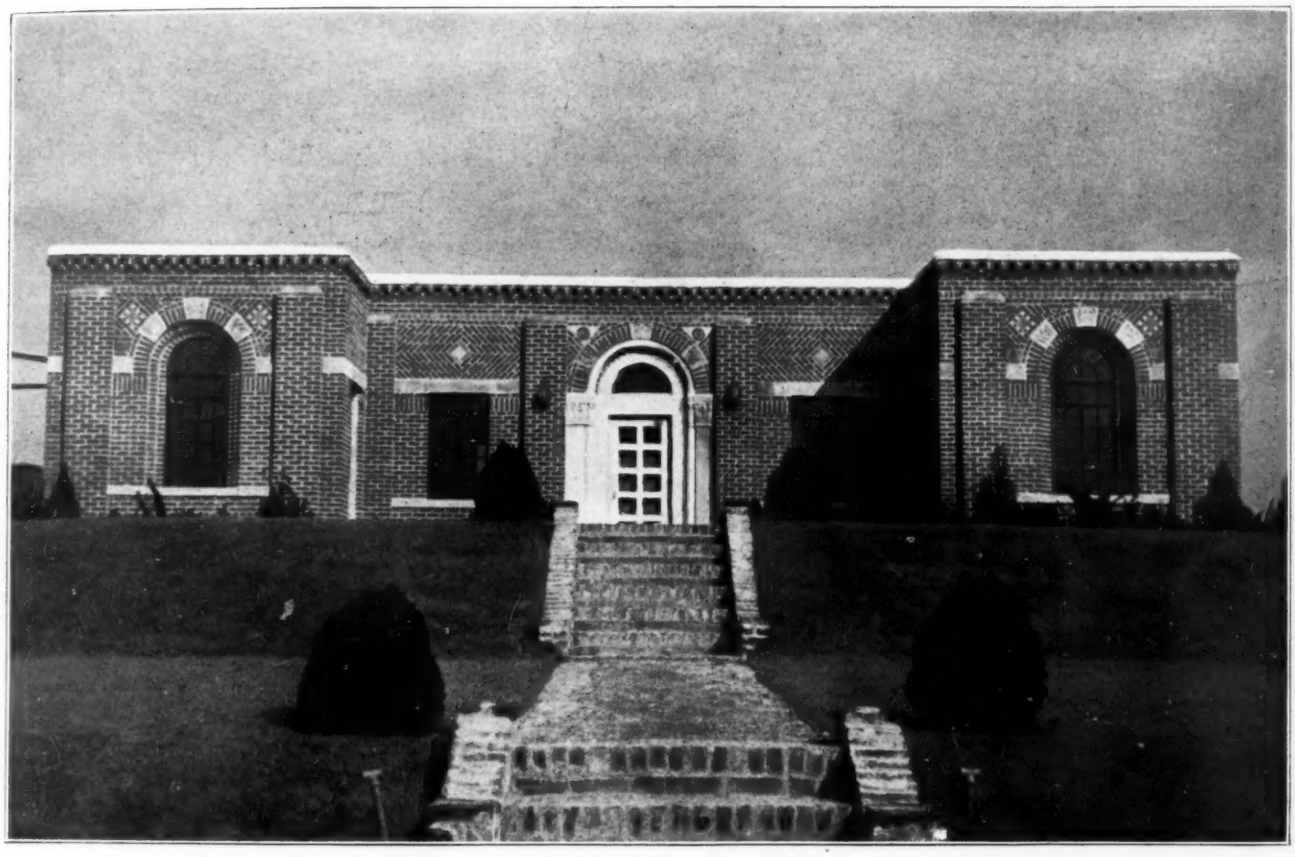
WATER WORKS AND SEWERAGE

August, 1933 — Editor — Vol. LXXX. No. 8



Administration and Laboratory Building New Sewage Treatment Works of Birmingham, Ala.

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Bleaching Clays in Water Purification

Waste and Pollution vs. Recovery for Profit

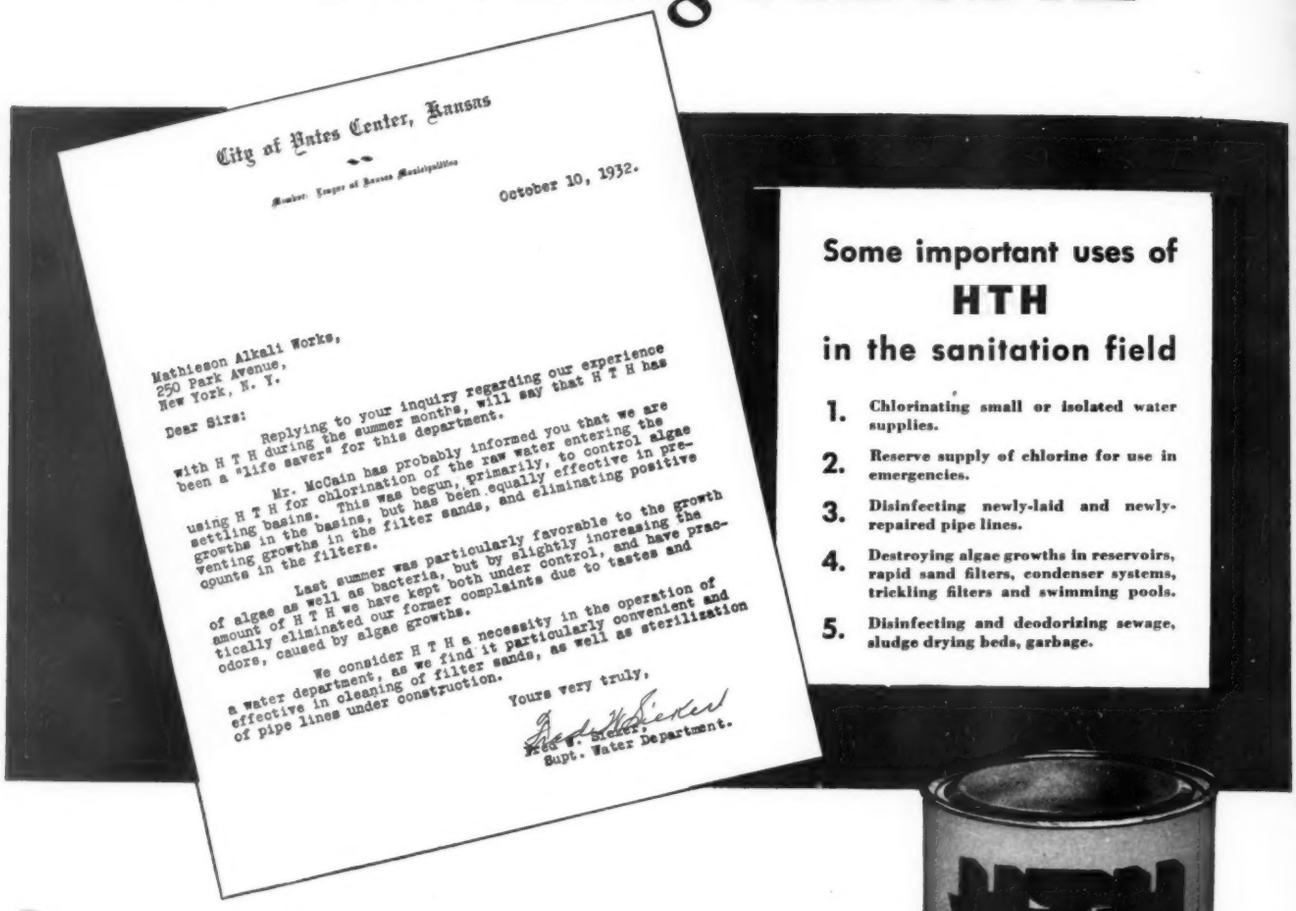
Proper Administration of Municipal Water Works

Vacuum Filtration of Sewage at Rockville Centre, N. Y.

Consumer's Good Will—Its Value and Method of Promotion

Cost of Analysis of Ensley Sewage Treatment Plant, Birmingham, Ala.

"HTH *has been a Life Saver* *in Controlling* ALGAE


City of Yates Center, Kansas
Member League of Kansas Municipalities
October 10, 1932.
Mathieson Alkali Works,
250 Park Avenue,
New York, N. Y.
Dear Sirs:
Replying to your inquiry regarding our experience with H T H during the summer months, will say that H T H has been a "life saver" for this department.
Mr. McCain has probably informed you that we are using H T H for chlorination of the raw water entering the settling basins. This was begun, primarily, to control algae growths in the basins, but has been equally effective in preventing growths in the filter sands, and eliminating positive counts in the filters.
Last summer was particularly favorable to the growth of algae as well as bacteria, but by slightly increasing the amount of H T H we have kept both under control, and have practically eliminated our former complaints due to tastes and odors, caused by algae growths.
We consider H T H a necessity in the operation of a water department, as we find it particularly convenient and effective in cleaning of filter sands, as well as sterilization of pipe lines under construction.
Yours very truly,
Fred W. Sieker
Supt. Water Department.

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1. **Chlorinating small or isolated water supplies.**
2. **Reserve supply of chlorine for use in emergencies.**
3. **Disinfecting newly-laid and newly-repaired pipe lines.**
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5. **Disinfecting and deodorizing sewage, sludge drying beds, garbage.**

There was a time when Yates Center, Kansas, was troubled with algae growths. Through eight or nine months of the year the water was clear and wholesome. But during the hot summer months, it acquired unpleasant tastes and odors.

Mr. Fred W. Sieker, Superintendent of the Water Department, knew what the trouble was, and in seeking an effective means of control, decided to try HTH. He used it in filter beds, settling basins—in every place where algae was likely to develop.

The results are described in the letter shown above, in which he says, "HTH has been a life-saver for this department...we have kept both (algae and bacteria growth) under control, and have practically eliminated our former complaints."

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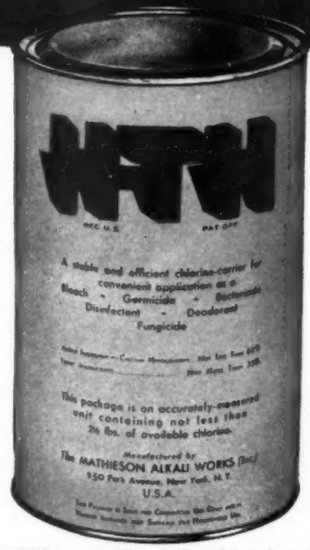
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WATER WORKS & SEWERAGE

L. H. ENSLOW, Editor

LEADING ARTICLES To Appear in the Next and Subsequent Issues:

Darwin W. Townsend, Principal Assistant Engineer of the Sewerage Commission of Milwaukee, has prepared two articles on "Screenings and Grit Incineration." A description of the new screenings incineration plant at Milwaukee will be presented in the September issue. Experiences in operation and operating cost data will be revealed in a second article.

Roger W. Esty, Superintendent of Water Works at Danvers, Mass., will recount interesting and unusual "Experiences in Locating Pipe Lines" with the wireless pipe locator.

R. W. Haywood, Jr., Superintendent of Filtration, Lehigh Water Company, in the September issue will describe the novel and interesting features of the new Filtration Plant of Easton, Pa.

J. S. Dunwoody, Superintendent of Water Department, Erie, Pa., tells of the methods followed at Erie in "Handling of Storage Yard Supplies and Equipment" in an article illustrated by specimen record forms and photographs.

Walter A. Sperry, Superintendent of Sewage Treatment Works, Aurora, Ill., will describe a study of flow through characteristics of sewage settling tanks and means evolved to create higher efficiencies including the installation of effective baffling devices.

Paul W. Frisk, Chemical Engineer, American Enka Corporation, Enka, N. C., will write on their experiences with iron and manganese in filtration practice and the methods evolved in maintaining cleanliness of the filters serving a large textile mill.

Joseph Cordillo, Supervisor of Water Service, Lehigh Valley Railroad, Sayre, Pa., will write on boiler water treatment practices with especial reference to the economy of methods employed on the Lehigh Valley System.

George H. Prindle, Superintendent of Water Works, Highland Park, Ill., writes on the important topic, "Using Perspective in Expenditures for Water Purification."

Arthur H. Miller, Superintendent, Water Department of Sheboygan, Wis., will write on Water Works Improvements at Sheboygan which includes the erection of one of the largest elevated tanks in the world.

Carl Leipold, Superintendent of Filtration, Winnetka, Ill., will continue with a series of articles of interest pertaining to the treatment of water.

John Strowbridge, Superintendent of Water Works and Sewerage, Dundee, N. Y., will describe "An Unusual and Economical Sewage Treatment Plant" wherein a unique method of operation is employed at a very low cost.

Sheppard T. Powell, Consulting Chemical Engineer, Baltimore, Md., will relate experiences with "The Corrosion of Well Casings by Electrolysis."

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II—Hydrogen and Hydroxyl Ions
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IV—Determination of pH
V—Sources of Error

Section B. PRACTICAL APPLICATION OF HYDROGEN ION DETERMINATIONS IN INDUSTRY AND SCIENCE

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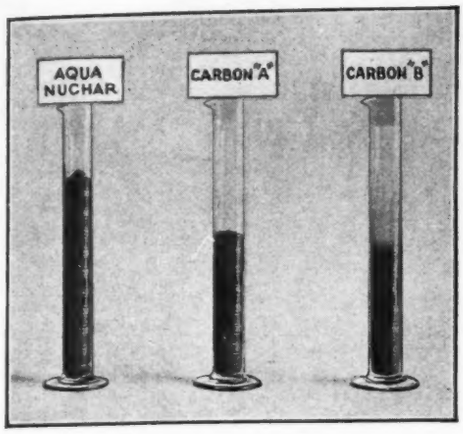

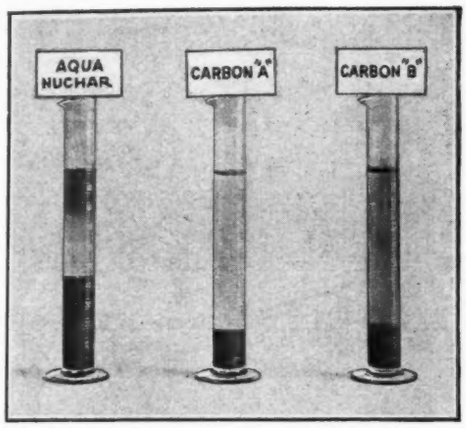

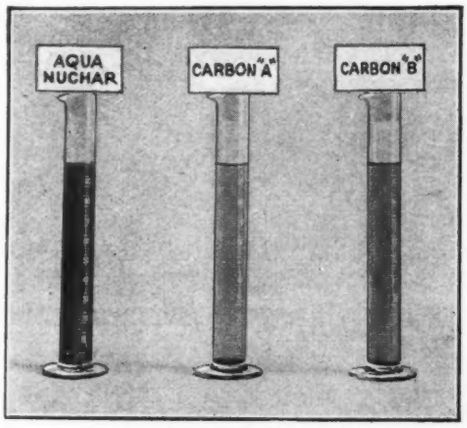

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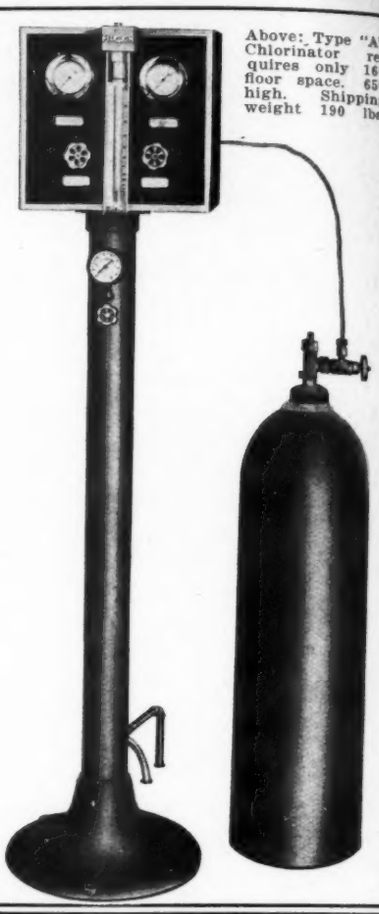

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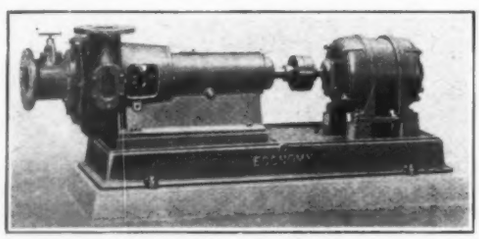

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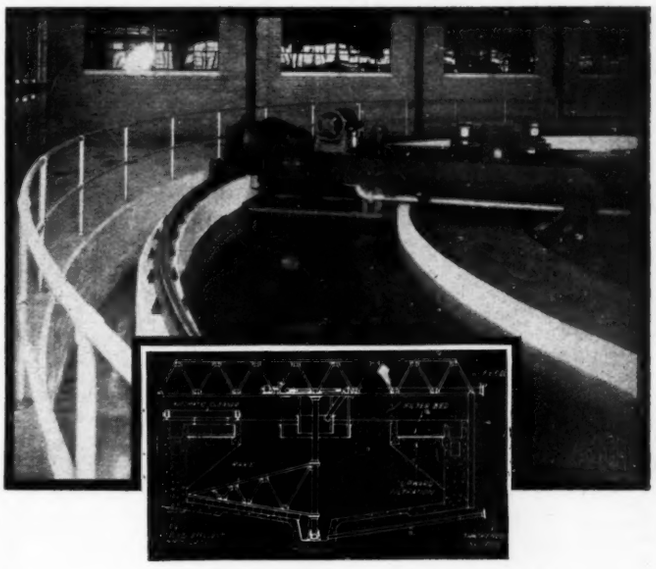

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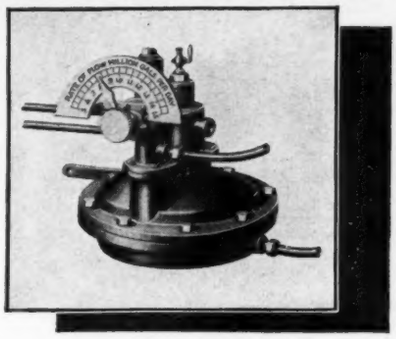

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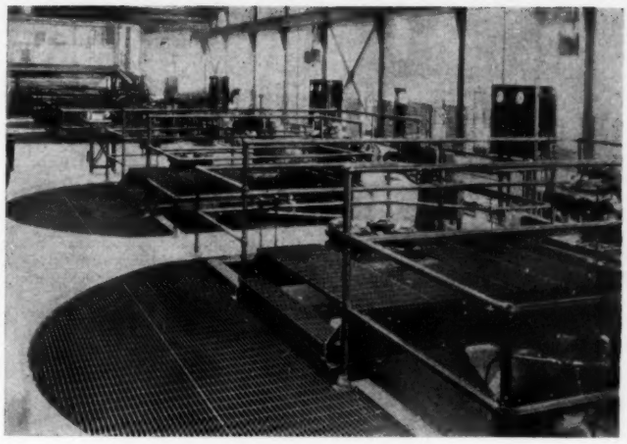

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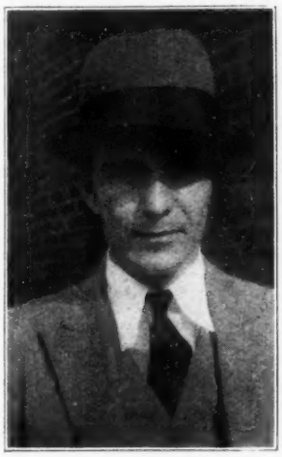
COST ANALYSIS OF THE ENSLEY SEWAGE TREATMENT PLANT, BIRMINGHAM, ALABAMA

By H. H. HENDON and M. E. BORRISS

Sanitary Engineer and Assistant Engineer, Jefferson County, Birmingham, Ala.

THE Ensley Sewage Treatment Plant will treat the sewage from the Village Creek drainage area, which is about forty-five per cent of the city of Birmingham. This plant was built by Jefferson County, Alabama, the contract being let September, 1932, and work was completed in March, 1933. This plant, of the separate sludge digestion type, is designed to treat 15 M.G.D. and consists of the following principal units: Bar screen, detritor, sewage-meter, two settling tanks, two sludge pumps, two gas collection type sludge digestion tanks, 24 sludge drying beds, screenings and scum incinerator, gas holder and administration building.



H. H. Hendon

A detailed description of these units and cost analyses follow.

Screenings

Screenings are collected by a Dorr Automatic Bar Screen having 1 inch clear openings, mounted over a screen channel 5 feet wide and 5 feet deep. Incomplete operating data indicates that we may expect a removal of 3 to 4 cubic feet of screenings per million gallons. These screenings are disposed of by burning in a Dorr Incinerator having a capacity of 75 cubic feet per 24 hours, using Anthony combination burners which operate on oil or digester gas. The screen and incinerator are housed in an attractive brick structure 20 feet by 35 feet, trimmed with cast stone. (See Figure 3.)

Nepal Privet and Jasmine planted around the building contribute a nice finished appearance to the structure. The interior of the building has concrete floors, brick walls painted a light green with a dark green wainscot. The ceiling is suspended metal lath and plaster painted white. The building contains, in addition to the screen mechanism, and incinerator, the operating switchboard for all units in the plant with the exception of that for the digesters which is located in the meter room of the Laboratory building (Figure 1). A work bench, tool cupboards, emery wheel and lockers are conveniently located in this building. Heat is provided by gas steam

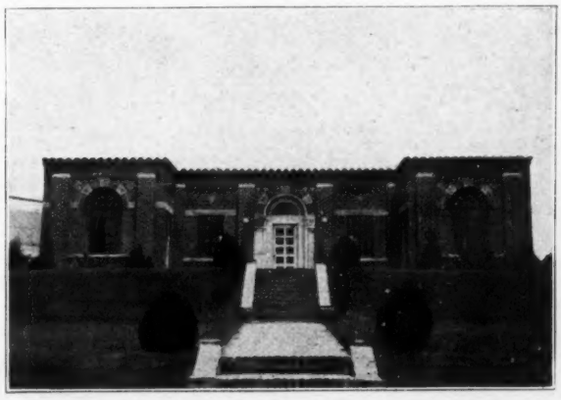


Fig. 1—Administration and Laboratory Building

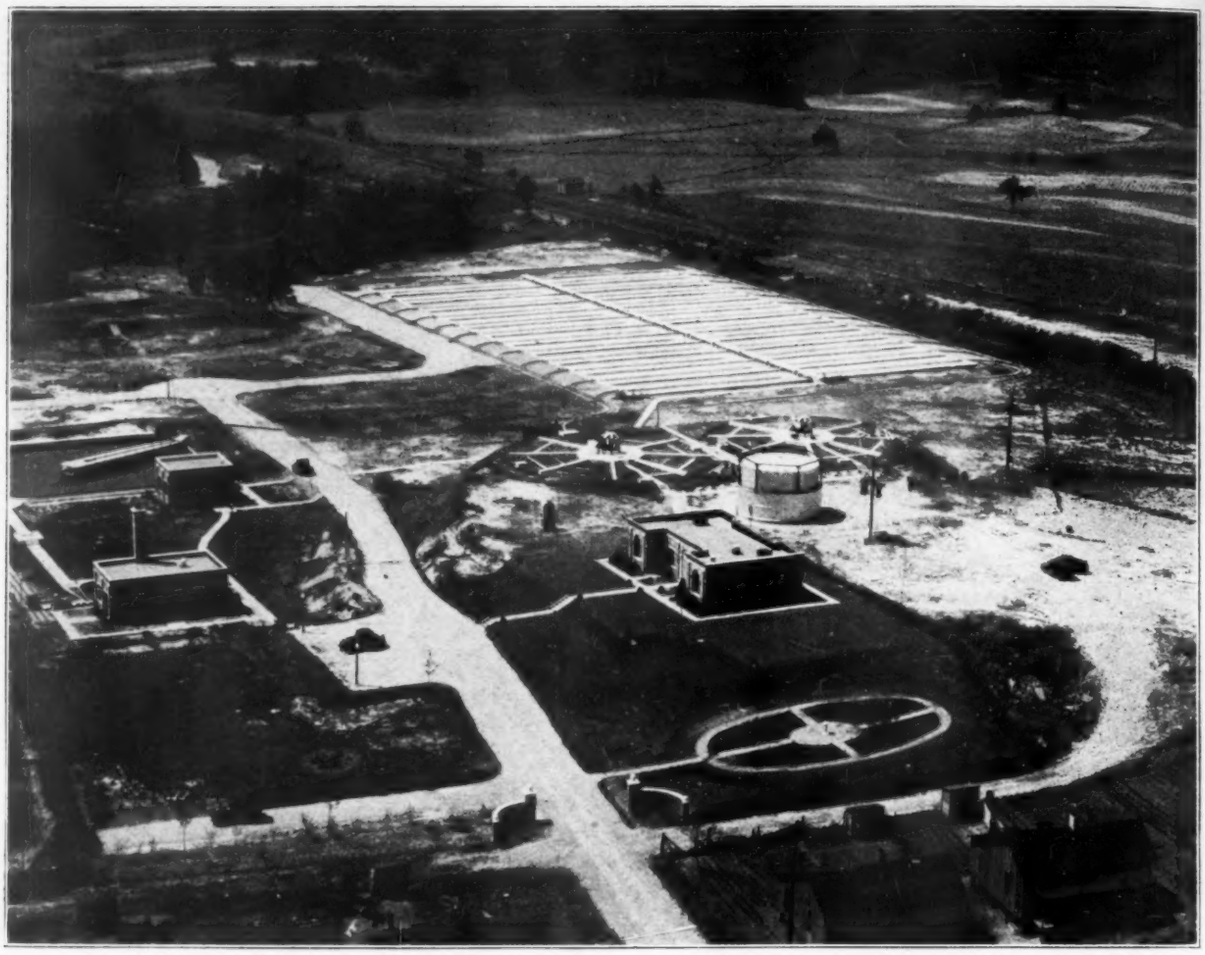


Fig. 2—An Aerial View of the New Sewage Treatment Plant, Birmingham, Ala. (Rose Garden to Right of Entrance Gate.)

radiators, using digester gas as fuel. The cost of this feature of the plant is given below with the major items set out as follows:

Automatic Bar Screen Mechanism	$2,500.00
Incinerator	3,340.00
Building	2,750.00
Misc., Piping, Valves, Electrical Wiring and other small items	603.01
Total	$9,193.01

Grit Removal

Grit is removed from the sewage by a square concrete tank, 22 feet by 22 feet, 2 feet 3 inches water depth. (See Figure 3.) This tank is cleaned by a Door Mechanism for collecting and removing grit and is controlled by two time clocks. This mechanism delivers the grit to a metal box which is hoisted by a chain block and emptied into an industrial car. This car is side-dump type and has a capacity of 18 cubic feet and runs on a 24-in. industrial track. A by-pass channel is provided so that sewage may pass direct from the screen to the settling tanks. Yellow-pine creosoted stop-logs are provided for this purpose. The influent, effluent, and by-pass channels are covered with galvanized subway grating. The mechanism above water is painted with aluminum paint, with a few touches of black. Green thorn bushes that have red berries are massed on all sides of the detritor tank, making a very attractive layout. The cost of grit removal may be itemized as follows:

Grit tank, including excavation and concrete work	$1,144.58
Collecting and removal mechanism	6,153.63
Electrical work, including switchboard and operating panel, automatic time-switches, electrical connections, etc.	328.96
24-in. industrial track, cars, switches, etc.	407.86
Piping	41.68
Subway grating	104.94
Miscellaneous	45.00
Total	$8,226.65

Few engineers younger than the author of this article can point to the completion of projects of the magnitude that Jefferson County, Alabama, is putting through under his supervision.

Fewer engineers can boast of works better designed and executed than those of the Birmingham District Sewerage Projects.

Still fewer can point to such low costs per capita when considering the modernized equipment installed at the new Ensley plant.

The cost data in this article reflects credit on the engineers and contractors responsible for the execution of plans and construction. And, it goes to show what a municipality can purchase in the nature of utility appurtenances and structures in times such as the present when construction work is so badly needed to give employment to men and business to industry. —Editor.

Sewage Meter

The Venturi type sewage meter is 36 inches by 18½ inches, with a maximum range of 22 million gallons per day. The differential producer is located in the channel between the grit detritor and the settling tanks. The mercury unit and head pipes are located in the pump house and the indicator, recorder and totalizer are com-

bined on a board in the meter room of the laboratory building. A concrete chamber surrounds the differential producer with steps provided to enter for the purpose of operating the cleaning valves. Subway grating covers these entrance holes. The cost of the meter may be itemized as follows:

Sewage meter, including differential producer, mercury unit, indicating, recording and totalizing units	$2,673.00
Reinforced concrete	99.37
Pipe and fittings	47.36
Subway grating and iron castings	31.61
Total	$2,851.34

Settling Tanks

Two settling tanks, constructed in parallel, have capacity of 12 m.g.d. at 2 hours' detention, or 24 m.g.d. at 1 hour. These tanks are 85 feet by 85 feet square by 10 feet side water depth, equipped with traction type sludge removal mechanism furnished by the Dorr Company, with side wall scum skimmer. The mechanism above water is painted with aluminum, trimmed in black. (See Figure 4.)

Scum, collected in a pit, is periodically pumped to the screen house where it is mixed with the screenings and burned.

All of the influent and effluent channels are covered with galvanized grating. An itemized cost of these units follows:

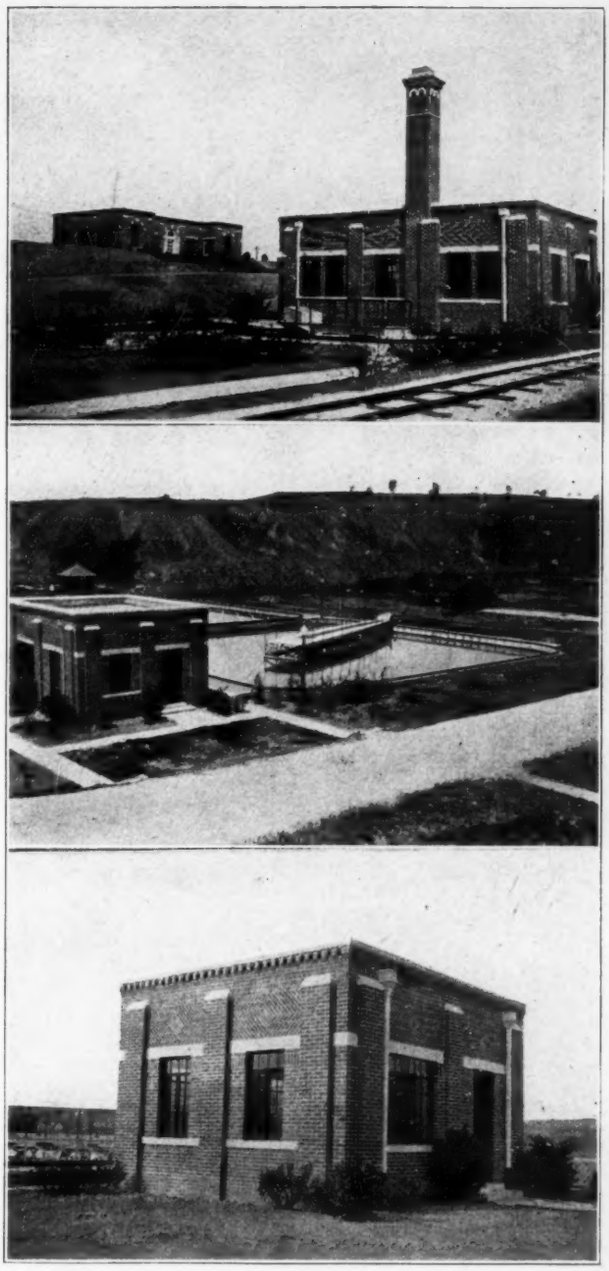
Excavation and removing old settling tanks	$ 1,816.10
Concrete reinforcing steel and 2 inch grout for bottom, including expansion joints	14,768.40
2 Dorr clarifier mechanisms	23,700.00
Piping and fittings	602.73
Switchboard, distribution panel and electrical connecnections	595.85
Grease skimming tank	90.00
Subway grating	1,216.62
Miscellaneous	216.50
Total	$43,006.20

Suldge Pumping

Sludge is pumped by two Barnes plunger type, constant speed, adjustable stroke, sludge pumps with a maximum capacity of 150 gallons per minute against a 20 ft. head. The pumps are cross connected in such a manner that each pump can be used to pump from either settling tank to either digester, recirculate sludge in either digester, pump sludge from the digesters to the drying beds (this is usually accomplished by gravity) or to pump scum from the scum pit to the skimming tank in the screen house. Normally one pump is used for pumping sludge from No. 1 clarifier to the digester; the other pump for pumping from No. 2 clarifier to the digester, the pumps being started and stopped by program electrical time clocks. These clocks permit a variable pumping time adjusted to a minute, throughout 24 hours. In this manner, the time of pumping may be adjusted to the concentration of solids in the sewage which varies considerably during the 24 hours, an operation practically impossible to accomplish by a program of manual starting and stopping. These pumps are housed in a brick structure 18 feet by 22 feet, which is identical in design and construction to the screen house previously described. (See Figure 5.) This building also contains a Wallace & Tiernan Dry Chemical Feeder for conditioning the raw sludge by the addition of lime.

The cost of sludge pumping facilities may be itemized as follows:

2 Barnes pumps	$2,300.00
Pump house	2,473.29
Piping and fittings	586.39
Switchboard, distribution panel, time clocks and electrical connections	817.81
Miscellaneous	15.00
Total	$6,192.49



Figs. 3 to 5—Upper: (Fig. 3) Screen and Incinerator House and Detritor. Administration Building on Left. Middle: (Fig. 4) Sludge Pump House and Settling Tanks. Lower: (Fig. 5) Sludge Pump House.

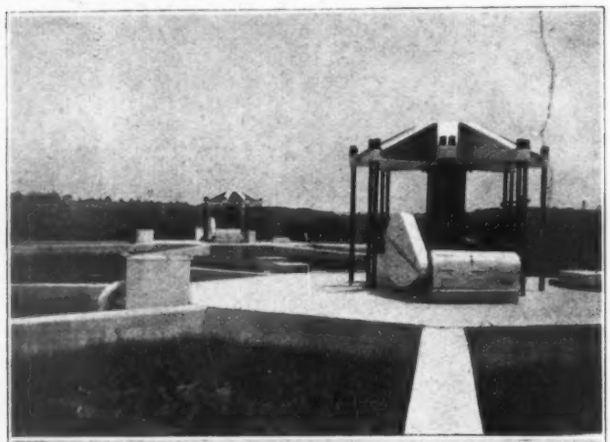
Digesters

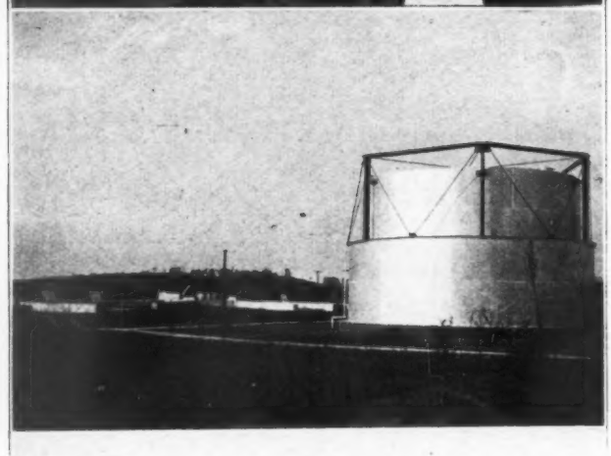
Raw sludge is digested in two circular concrete tanks 75 feet in diameter, 25 feet side depth. (See Figure 6.) These digesters are covered, are heated by circulated hot water, have gas collection facilities, and contain Dorr Digester Mechanisms. The digestion tanks were, perhaps, the most difficult units of the plant to build. The excavation was carried down nearly 30 feet through rock, cutting through two seams of coal. When grade was reached for the wall foundation, it was discovered that the last coal seam sloped in such a manner as to be under about one-half the circumference of one tank. This was removed and the wall foundation built up to grade with mass concrete, this being cheaper than lowering both tanks to a point below the coal seam. The walls were poured monolithically, requiring about 20 hours for each

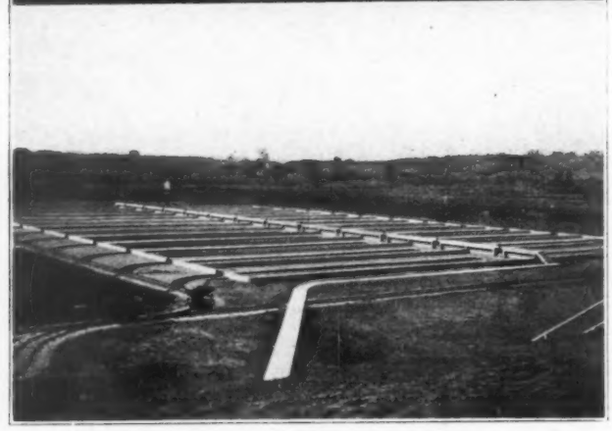
tank. The concrete roof, supported by structural steel, is gas proofed by 15 pound felt, mopped on with hot pitch and insulated by 16 inches of earth fill.

The cost of the two digesters follows:

Excavation	$ 7,816.40
Concrete and reinforcing steel	19,243.85
Dorr mechanisms	24,500.00
Piping and fittings	540.10
Electrical switchboard, distribution panel and connections	849.44
Gas proofing	241.80
Dry chemical feeder	406.00
Miscellaneous	184.64
Total	$53,782.23







Figs. 6 to 8—Upper: (Fig. 6) Dorr Digesters. Middle: (Fig. 7) Gasometer and Digester. Lower: (Fig. 8) Sludge Drying Beds.

Gas Collection and Digester Heating

Gas is collected from the top of each digester through a dome and conducted to the meter room where it passes through a rotary meter having a capacity of 6,000 cubic feet per hour. After being metered, it passes into a header to which the boiler, incinerator, laboratory and heating services are connected through meters. The excess gas escapes trough a pressure relief trap to an ornamental waste gas burner (See Figure 9), which is located between the laboratory building and the digesters.

Fig. 9—Ornamental Waste Gas Burner at Birmingham's Sewage Treatment Plant.

Since the production and utilization is metered the difference is the amount of gas wasted. A 5,000 foot gasometer is also connected to the header giving a constant pressure of 6 inches of water on the gas system. Gas production from the two digesters averages about 100,000 cubic feet per day—approximately 30,000 being utilized in the plant and the balance is wasted.

The digesters are heated by hot water system consisting of a Bryant gas-fired, thermostatically controlled, hot - water boiler with a rating of 1,200,000 B.t.u. per hour, a centrifugal pump with a capacity of 90 gallons per minute against a 10 foot head, a water meter for measuring the water circulated, a 4 inch cast iron pipe coil in each digester, 2 recording thermometers, a 100 gallon expansion tank, the necessary piping and valves.

All of the equipment, with the exception of the coils, is located in the meter room of the laboratory building. The temperature of the water going to and returning from each digester is recorded by the thermometers. A valved crossover for each digester is located in a valve chamber between the two digesters for the purpose of reversing the direction of the flow of water through the heating coils. An indicating thermometer for each digester is also located in this chamber. These thermometers indicate the temperature inside the digesters at a point about 15 feet from the wall and about half way down. In this manner, positive control of the temperature of the digesters is assured.

The hot water and gas piping is run from the digesters to the meter room of the laboratory building through a ventilated, electrically lighted concrete pipe duct 4 feet square. The duct is accessible through the valve chamber between the digesters which is entered by concrete steps.

An itemized cost of this feature of the plant follows:

Excavation	$ 299.45
Concrete and reinforcing steel	1,267.50
Digester heating boiler	1,025.00
5 gas meters	735.00
Hot water circulating pump	125.00
Recording thermometers	300.00
Water meter	185.00
Expansion tank	33.50
Piping, insulation, valves and fittings	4,191.76
Miscellaneous	408.05
Total	$8,570.27

Gas Holder

The gas holder is a single lift steel tank approximately 22 feet in diameter and 20 feet high, having a capacity

of 5,000 cu. ft. The tank is painted aluminum and trimmed in black. (See Fig. 7.) The cost in place, including foundtaion and necessary piping was $2,386.49.

Sludge Drying Beds

There are 24 sludge drying beds, each 25 feet wide and 100 feet long, arranged 12 on each side of a center wall of concrete upon which rests the sludge feed line and a platform for operating the control valves. (See Figure 8.) Each bed is underdrained by four lines of 4 in. drain tile laid with open joints connecting to an 8 inch T.C. line. Over this tile is 9 inches of 1½ inch to 2½ inch blast furnace slag, 6 inches of ¼ to 1½ inch slag, a 1 inch layer of fine slag and finally, 6 inches of filter sand. Dried sludge is removed by hand loading side dump industrial cars, having a capacity of 18 cubic feet. These cars travel on a 24 inch industrial track which runs onto each bed by removing a stop log inserted in the concrete wall at the end of the bed. This track leads from the drying beds to the sludge dump, a distance of about 300 ft., and continues about 400 ft. to the scheen hous. Itemized cost of drying beds follows:

Excavation	$ 586.50
Concrete and reinforcing steel	4,929.84
Slag	5,076.77
Filter sand	2,300.20
Under-drainage system	3,721.32
24-in. industrial track, cars and switches	3,588.57
Piping, valves and fittings	1,659.65
Miscellaneous	146.05
Total	$19,008.90

Sludge Piping and Control Chambers

Included in this item are all pipe lines, valves, valve chambers outside of tanks and structures, necessary to carry sludge to and from the various units of the plant. These are 6 and 8 inch C.I. pipe.

Concrete valve chambers	$ 224.21
Piping and valves, including excavation	2,281.35
Total	$2,505.56

Outside Sewers

Under this item we have included the cost of the following: 79 ft. of 42-inch brick sewer connecting the present outfall sewer to the new plant. 281 ft. of 36-inch brick sewer for by-passing sewage beyond the screen house. Sewers, catch basins and manholes necessary for surface drainage. Drains from tanks and structures. The total cost of the above was $4,735.58.

Water Supply

The plant is served by two separate water supplies; city water, furnished by the Birmingham Water Works Company through a 2-inch main, is used in the laboratory, shower room, for drinking, and in general where potable water is required. Water for washing, buildings, yard use, and general utility is taken from the Tennessee Coal, Iron and Railroad Company's industrial water supply. This water is taken from a reservoir fed by Village Creek, and located a few miles below the plant.

City water	$ 468.48
Creek water	880.14
Total	$1,348.62

Administration Building

The Administration Building is a brick structure 30 by 56 feet, trimmed with cast stine and tile. (See Fig. 1. The interior of the building has concrete floors, painted brick walls and metal lath plastered ceiling. Heat is provided by a low pressure steam heating system, using digester gas as fuel. The laboratory 20 ft. wide and 29 ft. long occupies the central portion of the building. At one end is the office (12 by 18 ft.) and the dressing and shower room which is 12 by 12 ft. At the opposite end there is a meter room and shower room. The meter room contains the digester boiler, building boiler, gas meters, Venturi meter instruments, electrical switchboard, and meter, digester switchboard, circulating hot water pumps, water meter and expansion tank.

Harry H. Hendon, Jr., Helping Dad

The Administration Building cost	$5,600.00
Laboratory equipment	1,400.00
Total	$7,000.00

Miscellaneous

In order to reach the site of the plant it was necessary to build 2,000 feet of approach road. There is also about 800 feet of road within the plant site. This road is constructed of a 6-inch crusher run slag base with a 2-inch fine slag top. There is provided at the entrance an attractive brick gate. (See Fig. 2.) To right of this entrance, is a rose garden containing about 500 plants. About 2,000 additional plants were used about the site.

Lighting standards (12 feet high) with 300-watt lights are provided for night operation. An itemized cost follows:

Roads and drives	$1,500.00
Concrete work	209.08
Lighting standards and wiring	1,236.47
Sidewalks	511.45
Plants	315.47
Total	$3,888.21

The total project cost, per cent of the total cost represented by various units, cost per capita, cost per million gallons, and the cost per unit of volume, or area, are given in Table I.

This plant was built by the County Commission of Jefferson County, Alabama, composed of W. E. Bishop (President), W. E. Corning, R. E. Smith. Fuller & McClintock, New York City, served as Consulting Engineers and Christie, Hutchinson & Burton, Birmingham, Alabama, were the contractors. The senior author designed and supervised construction of the plant and now has charge of its operation.

TABLE I.

	Total Cost	% Total Cost	Cost per Million Gallons	Cost per Capita	Cost per Cu. Ft.	Cost per Sq. Ft.
Screenings	$ 9,193.01	5.3	$ 612.86	$0.061	$ ...	$367.72
Grit removal	8,226.65	4.7	548.44	0.055	6.55	17.00
Sewage meter	2,851.34	1.7	190.09	0.019	....	.....
Settling tanks	43,006.20	24.9	2,867.08	0.286	0.29	2.97
Sludge pumping	6,192.49	3.5	412.83	0.041	....	.....
Sludge digestion	53,782.23	31.2	3,585.48	0.358	0.26	.....
Gas collection	8,570.27	5.0	571.35	0.057	....	.....
Gas holder	2,386.49	1.4	159.10	0.016	0.48	.....
Drying beds	19,008.90	11.0	1,267.26	0.127	....	0.31
Sludge piping	2,505.56	1.5	167.04	0.017	....	.....
Outside sewers	4,735.58	2.6	315.71	0 031	....	.....
Water supply	1,348.62	0.8	89.91	0.009	....	.....
Adm'st'n Bldg	7,000.00	4.1	466.67	0.047	0.43	.....
Miscellaneous	3,888 21	2.3	259.21	0.026	....	.....
Total	$172,695.55	100.00	$11,513.03	$1.150	....	.....

CONSUMER'S GOOD WILL—ITS VALUE AND METHOD OF PROMOTION

By FRANK C. JORDAN

Secretary,
Indianapolis Water Company

NEVER has "Customer Good Will" been of more importance to utilities than during this period of financial and mental depression when there seems to be a nation-wide feeling of animosity toward big business especially any business which thus far has escaped the sheriff's sale.

What is good will? An industrialist terms it "the greatest thing n business." An accountant calls it "an intangible asset." A business man describes it as "faith in an institution." A housewife thinks of it in terms of the confidence she has n her department store, grocery or drug store. Leading business institutions of all kinds count it as an asset expressed in large black figures on their balance sheets.

Good will is founded on integrity of service, and I like to think of all water works people as striving toward that completeness of service which is synonymous with integrity.

Let me emphasize a fact which all of us know but which some of us occasionally forget, namely, no business maintains a more intimate contact with the home than does the public water supply, and that we have an opportunity of building good will through all hours of the day and night by giving a fine service in a courteous and business-like manner.

Gradations of Good Will

There are several gradations of customer good will but just for the moment we will think of but two, namely, passive good will and aggressive good will. Your department store, as a rule, does not expect more than passive good will from you and your family. If you are satisfied with your dealings with the store and make repeated purchases, the store feels that it has accomplished its purpose insofar as you are concerned—it has your confidence or good will. Seldom do you go out of your way to say something good of the store from which you are making your purchases. By the same token, you need hardly expect more than passive good will from the water users and should not feel aggrieved if they fail to commend your utility service to the degree which you think its excellence merits.

Contrasted with the large number of patrons who apparently have a good feeling towards the water organization, there is that small but vociferous outer fringe of complainants who make so much disturbance in their demands for the impossible, as to distort our viewpoint and frequently cause us to forget the quiet majority who give the organization reasonable credit for furnishing a satisfactory service. The late Theodore Roosevelt termed this outer fringe the "lunatic fringe," and that term seems to fitly describe their activities. One of the big tasks confronting us today is that of steering our course and conducting our affairs according to the desires and rights of that great group of water users who bear a good feeling toward the utility.

Rules and Regulations Unpopular

Because a utility cannot select its customers it necessarily must deal with any one who makes application for service. Rules must therefore be made which will serve as a protection to the utility and its patrons, but those rules should not work to the annoyance or disadvantage of that large group of customers who desire to transact their utility business in a decent and business-like manner. Forty years' experience in the utility business leads me to say that reference to rules and regulations is distasteful to the average utility patron and it is far better for customer good will if we can deal with a customer without mention of restrictions or regulations.

In striving for customer good will we can be of unselfish service too. For water works people, like hotel operators, have a fine opportunity of building good will not only for themselves *but also for the city in which they live.* The new citizen locating in the city probably visits the utility office on the day of his arrival and the impressions then made on him are of a lasting character.

Good Will Made in the Front Office

Long experience has proven to me that good will is made in the front office rather than in the private offices. In other words, the men at the contract, telephone and cashier's windows, and our field representatives in the persons of our meter readers, are the ones who largely make or break good will.

The present mental and financial depression has occasioned many peculiar quirks in business, not the least of which is the very large increase in the number of our customer contacts. The increase in the price of postage stamps, together with the tax on bank checks, has caused a large number of our customers to come in person to the office to pay their bills. Requests for credit extensions and inquiries in reference to higher consumption also occasions many added calls. A recent survey in our office indicated that 66 per cent of the unusually large amount of office business which we are now handling is occasioned by some angle of the interesting times through which we are passing. Our customer contact personnel is now handling more personal customer contacts than they have probably ever handled before and much of this added work is of that trying nature which leads to exasperation if we are not careful. We have already increased the number of customer contact employes and are now preparing to operate a fifth contract window with a private desk to which will be sent those customers desiring and needing unusual help either from the water company or from the city's benevolent organizations.

There now exists an unusually satisfactory agreement between our company, the township trustee and the community fund, under which water service is being furnished to a large number of people who otherwise would be unable to have the service. I do not know of any single item which has done more to build good will than this active co-operation.

Meter Reader Training Important in Good Will Building

In this campaign to build good will I would place the cashiers, contract window, and telephone desk employes

in the front line trenches, and along side of them I would place our field representatives in the persons of the meter readers. These men are on the firing line, and to a large extent they do more towards making or breaking good will than can be done by those who are in authority. All of these employes should have at least a high school education; should be courteous, neat and painstaking, and sufficiently well versed in water supply business to answer any reasonable inquiry.

In our office meetings, attended by 100 of our employes whom we look upon as our customer contact employes, it has been brought out that we should at all times look to the interest of our patrons but that we should also be mindful of the company which gives us a living. A leak in the service line or water fixture beyond the meter is of interest to the user, and the detecting of that leak by our field representative—the meter reader—and reporting it to the consumer builds for Good Will on the part of the water user. The detecting of a leak on the street side of the meter likewise builds for good will on the part of the consumer as well as the water department because it gives evidence of efficiency in the water department organization. In one of our recent meetings one of the meter readers said in a paper: "Boys, the public gives you no credit for allowing a slow meter to remain in service. The customer expects you to collect the money to which the company is entitled and if you do not do it he thinks there is something wrong."

Three of our field representatives—meter readers—cooperated in the preparation of a paper on "Service Leaks" and outlined a plan under which the meter readers have located more than 500 underground service leaks, the reporting of which not only built for good will but at the same time saved us 1,500,000 gallons per day in pumpage.

Right here I want to say that the various meetings which we have held have not only caused better feeling on the part of our customers but have brought to us that peace of mind occasioned by a more efficient operation.

Continuity of Service Needs Closer Attention

In all probability the quality of the water supply is of first importance in building Customer Good Will, but close behind that comes continuity of service. Almost all of the water plants are now furnishing a water of high quality, but it is an unfortunate fact that the importance of continuity of service is frequently overlooked. I do not know of any more successful builder of ill will than unnecessary and frequent interruptions of water service.

In one city not far from Chicago the widening of a street necessitated some water main changes and a half day's interruption of the water supply. One of the big customers in the proposed shut out district called the office and said, "Please don't do that today. It will cost us $27,000." Needless to say the changing of the water main was deferred until an agreed time when the interruption would be of no serious consequence.

The repairing of valves and hydrants is of importance but the shutting off of water on Monday—wash day—for the sole purpose of repairing a valve is a fine way to not lose good will but build ill will.

Many of our patrons are now finding it necessary to ask for credit extension, and we are finding it difficult to distinguish between the man of honest intentions and the one who seemingly desires to beat the company. We have however pursued a very lenient policy and I firmly believe that the good will inherent in this policy offsets the loss of revenue caused by those who apparently take advantage of this liberality.

Like most water companies, we operate our service department on the 24-hour basis and we find that our customers deeply appreciate their ability to get special service at any hour of the day or night, and when the night man renders this service as if he were glad to do it, good will is furthered and we frequently hear from it.

The Value of a Publicity Program—In Short, Advertising

I believe that all water works organizations desire to furnish a thoroughly satisfactory service, but I sometimes find myself wondering whether we have availed ourselves of every avenue leading towards the creation of good will. One thing of which I am certain is that *we have failed to tell our story to the public.* If the water department has a serious breakdown; a shortage of water at time of fire; a bad taste and odor in the water; a contaminated public water supply caused by cross-connection with some private supply, or unsatisfactory service during a heavy sprinkling load, these facts are duly spread in the public press—frequently on the front page—and the water works organization comes in for its full share of criticism. If, on the other hand, through excellent construction, efficient operation and painstaking effort none of these things occur and the water users receive a thoroughly satisfactory supply of good potable water, no mention of such fact is made in the press and the public expects such service as a matter of course.

For years the Indianapolis Water Company has engaged in a publicity program sometimes very extensive in nature and it has certainly been of benefit as a builder of good will. From time to time, however, it has been brought home to us that we have not done enough along this line and our public relations have suffered thereby. We have issued all sorts of pamphlets, blotters, etc., and just recently we issued a very interesting booklet entitled "Water Service," and the hundreds of letters which we have received indicate that the good will occasioned by that publication far outweighs its cost.

A motion picture machine in our office lobby attracts much attention and in the four reels we show in a very attractive manner practically all phases of our construction and operation. Step into the office at almost any time and you will see boys and girls giving rapt attention to this advertising medium.

We utilize our office lobby for all sorts of exhibits from the most elaborate plumbing fixtures and 16-cylinder automobile engines to pies, beans and meats "such as Mother used to make." Some of our most interesting exhibits were those of moderately priced bath room fixtures—and obtainable from dealers on the partial payment plan.

Trips of inspection to our various plants are good will builders, but we have realized that only a small percentage of our citizens can be counted on to visit the filter plants and pumping stations. We are, therefore, preparing a rather elaborate motion picture which will show water works construction and operation, uses of water, etc., and we believe that this, when shown before luncheon clubs, civic organizations, schools, churches, etc., will do much towards building better feeling and will give the public some idea of what is behind the water that flows so freely from the kitchen sink or bath room faucet.

As time goes on I believe that our budget for advertising and publicity expenses will be larger and larger as we realize to a fuller extent the far reaching importance of telling our story to the public.

Acknowledgment.—The above paper was presented before the convention of the American Water Works Association at Chicago on June 12, 1933.

Constant Head Flow Meter

By WESTON GAVETT

Sanitary and Hydraulic Engineer, New York, N. Y.

THE usual means for measuring the rate of flow of liquids are weirs of various forms, submerged orifices or Venturi tubes. All of these methods require a considerable loss of head for the range of flow usually required. The relation between loss of head and rate of flow with weirs or orifices is not a straight line but is expressed by an exponential formula. To convert the head variation to a straight line movement for the purpose of integrating the flow, cams or similar devices are required.

While the constant orifice and variable head type of meter is widely used, the advantages of the constant head, variable orifice type of meter seem to have been neglected by hydraulic designers. The principle is used, however, in the well known air meter of the New Jersey Meter Company. Constant head variable orifice meters designed by the writer were installed in the new sewage treatment works at Morristown, N. J., to indicate the rate of flow of the plant effluent and also the returned and waste activated sludge. The meters are of the general form shown in the diagram and consist of a submerged stationary tube with two narrow longitudinal orifices. A circular plate fits loosely in the tube and is supported by chain which is counterweighted at the other end and hung over sheave. Floats, first employed, were made to fit too snugly in tubes and were replaced by counterweighted plates which have functioned satisfactorily.

The operation of the meter is apparent. When there is no flow, the plate is raised to its highest position by the unbalanced counterweight. A stop is provided to prevent the plate being pulled higher than the minimum flow position. When the flow starts a head is built up above the plate. When the difference in level between the up and downstream sides of the meter reaches the design loss of head, the plate and counterweight balance. A slight increase in head will move the plate until equilibrium is established, when sufficient orifice is exposed to pass the flow at the predetermined fixed head. The counterweight must be sufficient to balance the dead load of plate and connections and in addition, an amount equal to the area of plate, times unit weight of water or liquid, times the head. In lieu of counterweighted plate, a float may well be used, with bouyant force of float equal to area of float, times weight of water, times loss of head. The meters have the following dimensions:

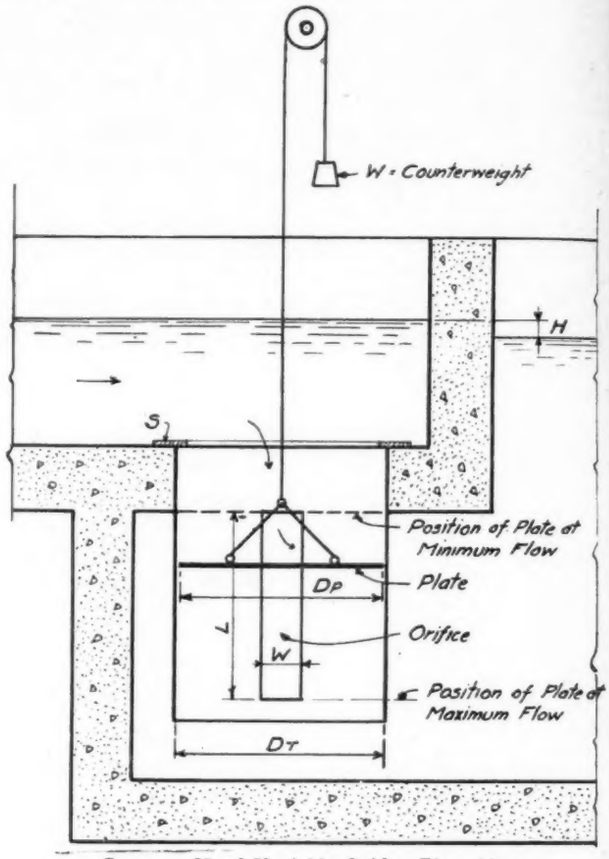
	Effluent Meters	Sludge Meters
Dt = Diameter of Tube.....	30 inches	12 inches
L = Length of Orifice*.....	40 inches	18 inches
W = Width of each orifice.....	6 inches	4 inches
Dp = Diameter of Plate.....	29.75 inches	11.52 inches
Effective counterweight	60 lbs.	2.425 lbs.
H = Loss of Head.....	0.2 ft.	0.054 ft.
Minimum flow	113,000 g.p.d.	44,300 g.p.d.
Maximum Flow (full open)....	4,728,000 g.p.d.	761,000 g.p.d.

The float type of a water stage recorder is secured to the counterweight cable of the large meter providing a graphic record of the flow. As the head flow relation is a straight line, the total flow for the day may be determined by planimetering the chart.

The meters were calibrated from the formula $Q = 0.6A\sqrt{2gh}$ in feet second units or $Q = 21{,}500\ A\sqrt{h}$; wherein Q = rate of flow in gallons per day, h = the constant difference in head in feet, and A is the area of exposed orifice in square inches. The minimum flow occurs when plate is at upper end of orifice and the area of orifice is the annular space (clearance) between plate and tube. The area of annular space is added to area of exposed orifice to compute flow at various points.

Some of the advantages of the constant head type of measuring device are:

1. The loss of head is constant, and may be very small, 0.1 ft. or less. This is of particular value in sewage works, when head is limited.



Constant Head-Variable Orifice Flow Meter

2. The meter is actuated by difference in head as the orifice is submerged. The water level on both sides may vary without affecting the operation of the meter.

3. The relation between movement of meter and flow is a straight line, unlike weirs, fixed orifices or Venturi meters. This feature permits graphic records from flow meter to be planimetered to give total flow.

4. Movement of plate in tube is practically frictionless. Plate may fit loosely in tube. The annular space between plate and tube provides a constant orifice which gives a minimum flow when none of the orifice in tube is exposed.

5. The range of the meter can be varied by changing the counterweight. The meter may be set for a small flow with light counterweight when a plant is started. Later when a larger capacity is required it may be easily provided by increasing the counterweight.

6. Sewage solids are not deposited in channel such as takes place when weirs are used.

7. The design is well adapted for synchronized flow. The flow of chemicals may be controlled by the main flow meter, or returned sludge and sewage flow meters may be synchronized in activated sludge plants.

8. Where meter is used to measure effluent flow to tidal waters it may be arranged to act as tide valve or check valve by the provision of a plate "S" on top of meter tube as shown in diagram.

*Each meter tube has two orifices.

VACUUM FILTRATION OF SEWAGE AT ROCKVILLE CENTRE, N. Y.

By WM. GAVIN TAYLOR, C. E.*

Wm Garvin Taylor

DISPOSAL of the effluent from the activated sludge plant at Rockville Centre, Long Island, N. Y., by percolation into the ground water, through native sand seepage beds has been a source of acute operating difficulties and material expense.[1] Finely divided suspended solids, normally to the extent of five to ten parts per million, have been carried over with the effluent from the secondary settling tanks following aeration treatment to be deposited as a gelatinous film which seals the surface of the sand beds. This frequently occurs when the beds are most needed. Absence of any running stream near the treatment plant site, located as it is in an expensively developed residential area necessitates practically perfect plant operation to effect, continuously, a satisfactory disposal. On some occasions a degree of bulking, or a temporary disturbance, in the secondary tanks adds to the difficulty of keeping the sand beds open, by causing increased quantities of suspended matter to be discharged by the effluent. A further handicap has arisen through population growth and extension of the sewer system into newly developed territories, which has increased the normal daily rate of sewage flow to a point beyond the working capacity of the plant.

*Taylor and Eisner, Consulting Engineers, Newark, N. J.
[1]See WATER WORKS AND SEWERAGE, August, 1932, pp. 265-267.

The Selected Method of Solving the Difficulties

Solution of this difficult sewage disposal problem is to be effected through mechanical vacuum filtration of the secondary tank effluent to render it practically free from suspended solids and also the settled sewage will be filtered prior to activation. After detailed investigation and study this scheme of treatment was adopted as the most favorable and economical remedy apparent. Construction of the vacuum-filter clarification plant was begun in January, 1933, and is at this writing undergoing acceptance tests. Designs, specifications and contracts for advertisement and public bidders, were prepared by the writer's firm and the contract for vacuum filters and mechanical equipment was awarded to Municipal Sanitary Service Corporation, of New York City, it being the lowest bidder. The contract for building construction was awarded to D. R. Longenecker, of Rockville Centre, L. I.

The filtering equipment comprises three vacuum filters, each having a capacity for filtering not less than three million gallons daily, two of which are being operated

Original Sewage Treatment Works Showing Blower House from Main Entrance with Aeration Tanks to Left

alternately to reduce the suspended solid content of the secondary tank effluent to not more than one part per million. The third filter is convertible for use either for filtration of settled raw sewage or for dewatering sludges and waste filter cakes preparatory to direct incineration without digestion or atmospheric drying. Included with the mechanical apparatus are sewage and vacuum pumps, paper handling and pulping equipment, chlorinating apparatus and similar accessories.

When the filtration equipment is in regular operation, in conjunction with the existing activated sludge plant, raw sewage is diverted after settling in the primary tanks and pumped to the vacuum filtration plant to produce a filtrate containing not more than ten per cent of the solids in the crude sewage. Early tests indicate that filtrates may be produced containing less than 5 p.p.m. of filterable solids. This filtrate is then delivered to the aeration tanks. It is possible to divert any desired portion of the settled raw sewage to the filters in order that the suspended solid content of the influent to the aeration tanks may be held at the optimum operating point determined by the condition of the activated sludge in the aeration tanks. The aeration and secondary tanks are operated as before except that the effluent from the secondary tanks instead of being discharged directly to the sand beds is passed through two parallel vacuum filters.

During the hours when the crude sewage is relatively weak, settled raw sewage passes directly from the primary tanks to the aeration tanks without filtration so that the convertible filter, normally used for filtering crude sewage, may be operated as a unit for dewatering sludges and filter cake.

The operation of the vacuum filters for sewage treatment follows closely the procedures in use in industrial applications of such filters. When filtering sewage proper, to procure greater efficiency of clarification, paper pulp is added to the sewage to produce a most satisfactory filter medium on the surface of the vacuum filter. At Rockville Centre mixtures of newsprint, boxboard cartons, boxes and other waste materials are sorted out from the municipal refuse collections, and are baled, delivered to and stored at the sewage filtration plant. After weighing out a batch of paper it is shredded in a motor-driven "Jeffrey-Type B" swing hammer pulverizer, having a capacity of 1,000 pounds per hour. In this apparatus the coarse paper is reduced to shreds. The pulp is discharged into masonry paper pulp storage tanks, equipped with mechanical agitators, located immediately beneath the shredder in which the pulp is retained in a water mixture containing approximately 4 per cent of paper stock. From these it is added to the sewage as required. The pulp pumps, which are in duplicate, are connected by piping so that the contents of the tanks may be reshredded, circulated from top to bottom, one tank to the other, or in any other manner as may be required to maintain uniform pulp consistency and favorable fibre length.

The Filters and Their Operation

Each filter consists of an electrically-driven cylindrical drum 16 feet long and ten feet in diameter mounted in a pan or vat so that 70 per cent of the cylindrical surface of the drum is submerged when the sewage in the pan is at normal operating level. The outer drum surface of each filter is divided into thirty individual longitudinal filtering compartments formed by covering the separating fins with 14-mesh bronze woven wire and a filtering cloth. Spirally wound drainage wire placed between the mesh and the drum shell supports the mesh against deflection. Individual drainage channels connect the filtering compartments to main outlet valves at the ends of the filter. These are so constructed that continuous flow takes place. Sewage and pulp are admitted to the filter through an influent trough equipped with a motor-driven agitator to produce a thorough dissemination of the paper pulp particles throughout the sewage mass prior to delivery of the sewage from the influent trough to the vat.

As the drum rotates, vacuum is formed in each of the filtering compartments upon its submergence beneath the sewage level, causing a flow through the cloth and mesh into the interior drainage piping and to the filter outlet valves. The filter cloth checks the passage of particles of paper pulp which accumulate on the outside of the drum in the form of a mat. Further flows of sewage through the filtering compartment necessarily pass through this mat causing the sewage solids to be entrapped and release the clarified filtrate for discharge. At the end of a filtering cycle, the compartment emerges from the sewage still carrying the mat which adheres to the drum by reason of sustained vacuum. During the period of travel of the mat from emergence to the high point of the arc, the vacuum in the filtering compartment extracts additional moisture from the cake, leaving it sufficiently tractile for removal.

A series of endless cords wound about the drum and auxiliary shafts so that the cake in forming rests upon these cords as upon a conveyor, comprises the cake removal apparatus. The cake is discharged from these conveying cords into the influent trough where the agitator whips it into a pulp condition for further use. A single charge of paper pulp is thus used over and over again in the filtering process until the quantity of foreign solids which it accumulates is sufficient to materially lower the filtering rate. Paper pulp may be used and reused in this fashion until the cake consists of approximately equal parts of paper and foreign solids. When "pulp saturation" occurs the entire accumulation of cake is diverted for dehydration and a fresh charge of pulp is admitted.

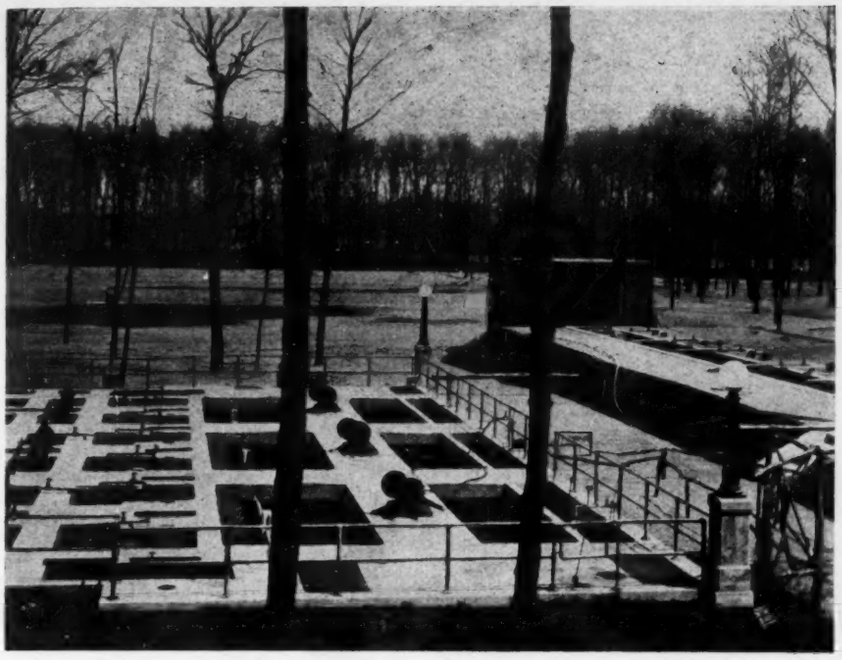
The vacuum for sewage filtration is automatically created within the apparatus by means of a barometric leg consisting of a closed outlet pipe discharging with its end submerged at a level considerably below that of the filters. Velocity of fall of the liquid (filtrate) through this outlet pipe creates the only required negative head to cause the flow through the filter. Five to ten inches of vacuum (mercury column) is in most cases adequate for operating the filters; at Rockville Centre the filters operate, without vacuum pumping, up to 11 inches of self-generated vacuum.

At the beginning of the filtering cycle, that is, when the compartment is first submerged into the sewage, there is no mat on the cloth to restrain the passage of the most minute particles of sewage solids. Consequently the first rush or flow through each of the compartments is not thoroughly filtered, but with continued flow the mat is quickly formed and thereafter proper filtration takes place. To avoid contamination of the effluent from the filter with the solids which may be contained in the first rush of liquid, filter outlet valves are designed and constructed to divert the first portion of the flow for refiltration. This diversion is limited to not more than 10 per cent of the total flow although satisfactory results may be obtained with a considerably lesser ratio of diversion. No such return is required, however, in the filtration of the sewage to be delivered for aeration.

Sludge and Filter Cake Dewatering

Dehydration of sludges and saturated pulp cake is carried on in the same manner as sewage filtration except

that higher vacuums are artificially created by means of a motor-driven vacuum pump having a capacity in excess of 1,100 cubic feet of free air per minute. The pump is of Pennsylvania manufacture and is equipped with a manifold piping system containing receiving tank, bypass, automatic vacuum reducing valve and all necessary appurtenances and accessories for operating the filters in any combination.



Aeration Tanks with Sludge Digestion Tanks in Rear

To increase the rate of dewatering sludge and waste filter cake the convertible filter is provided with a low level overflow to expose a large area of the drum surface to the atmosphere, and also with a canvas belt cake compressor to assist in the extraction of the moisture. Final cake, having not more than 73 per cent moisture content is guaranteed under the installation contract. At this consistency the cake is discharged into a storage bin, to be delivered by truck to the municipal incinerator for direct combustion with garbage and refuse, avoiding the need for digestion and other drying.

Sewage itself is used for washing the filter cloths and cords while the filters are operating. An auxiliary pressure pump, whose suction port is connected to the filter influent, discharges a portion of the incoming sewage to the filter through a pressure spray system to prevent accumulation of solid matter on the cloth or cords. When a filter is to be taken out of service temporarily, fresh water can be admitted into the spray system for final washing down.

Filter Building and Appurtenances

The building housing the equipment is 35 feet wide and 71 feet long, consisting of two stories and basement. It is of steel frame reinforced concrete and brick construction, containing in addition to the mechanical equipment, 1,200 square feet of garage space. In the basement, or pump room, there are two pairs of "Domestic" manufacture, open impellor type, electrically driven variable speed centrifugal pumps, each pair having a range of capacity from two to four million gallons daily. Pump motors are equipped with remote controls completely interlocked to the filter drive mechanisms. These controls permit close regulation of the discharge in order to conform to variations in the rate of sewage flow into the plant. In addition to the sewage pumps there are duplicate pulp feed pumps, the general utility pump for washing down the filtering equipment and a sump drainage pump—all of "Domestic" manufacture,—together with duplicate "La Bour" filtrate pumps for exhausting the liquid contents from the filter when under high vacuum.

The installation includes an "International" mechanical lime feeder for maintaining the pH value of the sewage within the optimum limits for efficient filtration, and also, duplicate "Wallace and Tiernan" chlorinators so that chlorine may be automatically applied, at will, to the influent or effluent from each of the filters.

All three of the vacuum filters are of the "Wright" type construction, are similar in design, with steel shells and vats, and string discharge mechanisms. Variable speed drive gearing permits adjustment of drum speeds within ⅛ to ⅝ R.P.M. for sewage filtration and within 1/10 to ½ R.P.M. during sludge and waste cake dehydration. The filter outlet valves are novel in construction, being designed for simplicity and ease of regulation. Flow inlets from repulping troughs to vats are constructed to obtain uniform rate of flow and uniform pulp consistency over the entire length of the filtering drum—a highly important feature. Visible indicators show at all times the apparent turbidity or clarity of the filtrate and the depth of liquid contents in the vat.

Approximately 45 kilowatts are required for all operating purposes, including lighting, heating and pumping of the sewage to each of the filters, less than 5 H.P. being required for individual filter drives. Electricity for power is supplied by a separate transmission line from the municipal generating station to the sewage plant. Direct electrical controls, the design of which was worked out with the coöperation of the General Electric Company, permit regulation of each plant operation with practically no manual labor. Pump and filter speeds may be electrically regulated, not only to follow the curve of sewage flow but also to obtain the best possible filtration when variation in sewage or pulp characteristics make such an adjustment necessary. All important pump controls are situated in the filter room so that the operator may secure immediate pump speed regulation which a visual indication of results indicates desirable.

All mechanical units are designed and arranged for convenient operation. The renewal of filter cloth may be accomplished within an hour. Damage to filter cloths or wire mesh upon which the cloth is supported is prevented by flexible mountings of the cake compressor elements. Automatic alarms are installed to signal the stoppage of pumps. Remote switches are provided wherever possible to facilitate observation of the results of operating the equipment.

Preliminary Results Attained

As a result of the installation of vacuum filters at

Rockville Centre the quantity of total solid matter discharged with the plant effluent is being reduced to between ten and twenty per cent of the total normal discharge when the plant was operated at *best efficiency*. Another result of vacuum filter operation at this plant is a definite increase in the working capacity of the plant through reduction of the solid matter delivered to the aeration tanks. With direct dewatering of sludges and filter cakes the need for operating digestion tanks and glass covered sludge drying beds is being eliminated, thereby causing a material saving in the total operating cost. Constancy of result is assured through mechanization rather than dependence upon biological activity for purification of the effluent. This plant is the first of its kind employing vacuum filtration as a direct sewage treatment process and ultimate results will be awaited with interest.

This novel plant is being constructed under the official direction of the Sewage Commissioners, with Mr. Harold E. Libby as Chairman of the Board and Mr. John S. Kneale as Superintendent of Sewers. The plant was adopted as a result of the investigations, report and recommendations made by Taylor and Eisner, Consulting Engineers, who have designed the plant and supervised its construction.

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North Carolina First School Conference for Water Works Men

THE convening of the Municipal Water Works Operators' School Conference at State College, in Raleigh, on June 28th and 29th, marks the first attempt of the State Board of Health to arrange for instruction in some of the fundamentals of the sciences that are involved in the production of a safe municipal water supply. Seventy-eight men attended.

The meeting opened with a lecture by Professor L. A. Whitford on "The Common Algae of Our Raw Water Impounding Reservoirs." A number of slides were employed to illustrate the talk. In the discussion which followed the presentation of this subject, the question was raised as to whether or not very minute algae are responsible for the sealing of filter beds when crustacea are numerous and are accepted as being the cause of the trouble.

Realizing that many of the men attending the School Conference had received no training whatever in bacteriology, Dr. I. V. D. Shunk of the State College faculty delivered a very interesting lecture on "Water Bacteriology." Dr. Shunk's talk was elementary in character in that the various types of bacteria were discussed and illustrated by drawings. The source of bacteria in water was discussed as was the significance of the presence of some organisms.

Mr. J. W. Kellogg, chemist and bacteriologist of the State Laboratory of Hygiene, presented a paper which dealt with Laboratory of Hygiene specifications for media and sterilization of apparatus for bacteriological work. During the course of this lecture a demonstration of bacteriological methods of analysis was staged by Mr. Lynn Maddry of the Laboratory of Hygiene.

Professor L. L. Vaughan, of the State College faculty, delivered a lecture on "The Construction, Operation and Care of Pumps" illustrated by various pieces of equipment which were opened up for inspection. A very lively discussion of the subject followed and Professor R. H. Fouraker spoke on "The Construction, Operation and Care of Induction Motors."

A very interesting and instructive paper was presented by Mr. A. B. Uzzle, Jr., Sanitary Engineer, city of Greenville, the title of which was "The Theory of Mixing and Coagulation as Applied to Water Purification." Mr. Uzzle pointed out the dangers attending under an overdosage of chemicals and gave the composition of floc at various iso-electric points; some advantages of iron over alum coagulant were discussed. A brief review was given of coagulating processes employed by various cities which involved iron coagulants, the return of sludge, efficacy of carbon, etc. The importance of intensity, time of agitation and the effects of temperature on floc production was also mentioned. In this connection the value of a stirring machine in making jar tests was touched upon. The paper closed with an outline of the various types of mixing devices which are in use at the present time.

Mr. D. S. Abell, Assistant Engineer, State Board of Health, presented a paper on the "Correlation of Jar Tests for Dry Feed Machine." In this paper Mr. Abell pointed out the necessity for applying chemicals in accordance with results obtained in making jar tests and the value of calibrating dry feed machines at frequent intervals.

At a dinner held in the college cafeteria on the evening of the first day, Mr. W. D. Collins, Director, Division of Quality of Water, U. S. Geological Survey, Washington, D. C., gave an illustrated lecture on the character and industrial utility of water in various sections of the United States.

A very helpful part of the program was a demonstration of the laboratory technique to be employed in ascertaining the aluminum, iron and manganese content of water. Following each demonstration the significance of the presence of the compounds of the element in public water supplies was discussed at some length. Messrs. Lynn Maddry and M. F. Trice, of the Laboratory of Hygiene and the State Board of Health, respectively, speaking on "Alum," Dr. E. E. Randolph on "Iron" and Professor C. S. Grove, Jr., on "Manganese."

Professor J. Summie Whitener delivered a lecture on "The Mechanics of Activated Carbon in the Removal of Tastes and Odors from Water Supplies" while Mr. H. F. Davis of the Wallace & Tiernan Company presented a very able paper on the "Use of Ammonia Chlorine Process in Water Purification."

Licensing of Operators Discussed

One of the most interesting subjects discussed at the conference was the "Proposal to License Operators of Municipal Water Filtration Plants." Mr. C. W. Smedberg, Director of Public Works and Service at Greensboro, led the discussion and presented the licensing system at the present time used by the state of New Jersey. The subject elicited quite a bit of discussion but no definite steps were taken towards setting up such practice in North Carolina, other than to appoint a committee of five to study the question. Mr. Smedbeg was selected as chairman of such a committee to include two employes of the Dvision of Sanitary Engineering of the State Board of Health.

Professor T. S. Johnson summarized for the gathering the provisions of the recently passed Industrial Recovery Act.

The meeting was attended by 78 men who were officially present as representatives of towns and cities in the state. The gathering expressed a desire to have such a School Conference annually and State College was selected as the meeting place.

Acknowledgment.—The above report was prepared for WATER WORKS AND SEWERAGE by M. F. Trice, Assistant Engineer of the North Carolina State Department of Health.

BLEACHING CLAYS

By JOHN R. BAYLIS
Physical Chemist, Bureau of Engineering, Chicago, Ill.

THE success of bleaching clays in the purification of certain industrial products has led to some investigation of its use in removing objectionable tastes and odors from water. Norcom[1] gave an account of the use of Pike's Peak Bleaching Clay at Chester, Pa., and concluded that it was well worth its cost in removing tastes from the Delaware River water. Others have reported some success with the use of the clay. Recently there have been attempts to mix the material with charcoal and potassium permanganate, or to deposit the char on the surface of the clay during the charring process. Also the writer has heard of attempts to incorporate the clay with aluminum sulfate in its manufacture. So many have asked the writer's opinion of the merits of bleaching clay, that it is believed that a short article may be appropriate at the present time. An extensive investigation of such materials has not been made, but with several samples which were submitted to the writer, a few tests have been made to see if the materials possessed merit worthy of serious consideration for water treatment.

The Lake Michigan water at Whiting, Indiana, was used for testing two of the bleaching clays. This water usually contains a readily noticeable oily and musty odor, and is thought to have some characteristics similar to the Delaware River water at Chester, Pa., where the clay is reported to be successful.

TABLE I—REMOVAL OF ODOR FROM LAKE MICHIGAN WATER AT WHITING, IND., WITH ATLAS BLEACHING CLAY

March 28, 1933

Test Number	Clay Added P. P. M.	Time Stirred Minutes	Aluminum Sulfate Added P. P. M.	Filter Used
1	0	60	0	None
2	0	60	0	Cotton
3	0	60	10	Cotton
4	100	60	10	Cotton
5	200	60	10	Co.ton
6	300	60	10	Cotton

COLD ODOR TESTS

(Temperature Approximately 20° C.)

Dilution	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
0	3-mo*	3-mo	3-mo	3-mo	3-mo	3-mo
1-10.....	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-20.....	2-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-30.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-40.....	1-mo	0	0	0	0	0
1-50.....	0	0	0	0	0	0

HOT ODOR TESTS

(Temperature about 70° C.)

Dilution	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
0	4-mo	4-mo	4-mo	4-mo	4-mo	4-mo
1-10	3-mo	3-mo	3-mo	3-mo	3-mo	3-mo
1-20	3-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-30	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-40	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-50	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-60	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-80	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-100.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-125.....	1-mo	1-mo	1-mo	1-mo	1-mo	0
1-150.....	1-mo	1-mo	0	0	0	0
1-175.....	1-mo	0	0	0	0	0
1-200.....	0	0	0	0	0	0

ODOR THRESHOLD NUMBERS

Cold	41	31	31	31	31	31
Hot	176	151	126	126	126	101

*m—Musty. *o—Oily. O—Odorless. 1—Very faint. 2—Faint. 3—Distinct. 4—Strong.

TABLE II—REMOVAL OF ODOR FROM WHITING, IND., RAW WATER WITH "PIKE'S PEAK" BLEACHING CLAY

April 11, 1933

The clay was obtained from the New Chester Water Company, Chester, Pa.

Test Number	Clay Added P. P. M.	Time Stirred Minutes	Aluminum Sulfate Added P. P. M.	Filter Used
1	0	60	0	None
2	0	60	0	Cotton
3	0	60	10	Cotton
4	100	60	10	Cotton
5	200	60	10	Cotton
6	300	60	10	Cotton

COLD ODOR TEST

(Temperature Approximately 20° C.)

Dilution	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
0	3-mo	3-mo	3-mo	3-mo	3-mo	3-mo
1-2	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-4	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-6	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-10.....	2-mo	2-mo	2-mo	2-mo	2-mo	1-mo
1-15.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-20.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-25.....	1-mo	1-mo	1-mo	1-mo	1-mo	0
1-30.....	1-mo	1-mo	1-mo	1-mo	1-mo	0
1-40.....	1-mo	1-mo	0	0	0	0
1-50.....	0	0	0	0	0	0

HOT ODOR TEST

(Temperature about 70° C.)

Dilution	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
0	4-mo	4-mo	4-mo	4-mo	4-mo	4-mo
1-2	3-mo	3-mo	3-mo	3-mo	3-mo	4-mo
1-4	3-mo	3-mo	3-mo	3-mo	3-mo	4-mo
1-6	3-mo	3-mo	3-mo	3-mo	3-mo	2-mo
1-10	3-mo	3-mo	3-mo	3-mo	3-mo	2-mo
1-15	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-20	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-25	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-30	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-40	2-mo	2-mo	1-mo	1-mo	1-mo	1-mo
1-50	2-mo	2-mo	1-mo	1-mo	1-mo	1-mo
1-60	2-mo	2-mo	1-mo	1-mo	1-mo	1-mo
1-80	2-mo	2-mo	1-mo	1-mo	1-mo	1-mo
1-100.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-125.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-150.....	1-mo	1-mo	0	0	0	0
1-175.....	1-mo	0	0	0	0	0
1-200.....	0	0	0	0	0	0

ODOR THRESHOLD NUMBER

Cold	41	41	31	31	31	21
Hot	176	151	126	126	126	126

Method of Testing

Five samples of water were prepared. One had no treatment whatever. The second sample had no treatment except that it was filtered through a small plug of washed absorbent cotton packed in the bottom of a glass funnel. It has been found that absorbent cotton is less likely to impart a taste or odor to water than any other type of filter.

The third sample was coagulated with 10 p.p.m. of aluminum sulfate and filtered through a plug of the cotton. The fourth sample had 100 p.p.m. of Atlas Bleach-

ing Clay added to the sample before it was coagulated with 10.0 p.p.m. of aluminum sulfate and filtration through a plug of cotton. The fifth sample had 200 p.p.m. of the bleaching clay added and it also was coagulated with 10.0 p.p.m. of aluminum sulfate and filtered the same as the other samples. The sixth sample was treated the same as the fourth and fifth, except that 300 p.p.m. of the clay were used. All of the samples were stirred in one-liter beakers for one hour at a velocity sufficient to form a good flocculation in the samples treated with aluminum sulfate.

Examination of the results given in Table I indicates no material adsorption of the odor by the clay, though the sample in which 300 p.p.m. were added had the odor reduced slightly more than it was reduced in the other samples. The clay, however, did aid in forming a floc which would settle out rapidly in the settling basin. Aluminum hydroxide adsorbs certain compounds and in this case it is believed that nearly all adsorption of the odor-producing compounds was effected by the aluminum hydroxide precipitate and not the clay.

Pike's Peak Bleaching Clay was used in another test with the Whiting water. This was a sample of water collected at another time but it had about the same odor as the sample used for the test shown in Table I. The tests were conducted in the same manner as those involving the Atlas clay and most identically the same results obtained as indicated in Table VI. Certainly the results do not indicate adsorption of this particular type of odor producing substance to any considerable extent.

TABLE III—REMOVAL OF ODOR PRODUCED BY OIL REFINERY WASTE WITH ATLAS BLEACHING CLAY

March 24, 1933

Test Number	Clay Added P. P. M.	Time Stirred Minutes	Aluminum Sulfate Added P. P. M.	Filter Used
1	0	120	0	None
2	0	120	0	Cotton
3	0	120	10	Cotton
4	100	120	10	Cotton
5	200	120	10	Cotton
6	300	120	10	Cotton

COLD ODOR TESTS

(Temperature Approximately 20° C.)

Dilution	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
0	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-1	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-2	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-4	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-6	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-8	1-mo	1-mo	1-mo	1-mo	1-mo.	1-mo
1-10.....	1-mo	1-mo	1-mo	1-mo	0	0
1-12.....	1-mo	0	0	0	0	0
1-16.....	0	0	0	0	0	0

HOT ODOR TESTS

(Temperature about 70° C.)

Dilution	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
0	4-mo	4-mo	4-mo	4-mo	4-mo	4-mo
1-1	3-mo	3-mo	3-mo	3-mo	3-mo	3-mo
1-4	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-8	2-mo	2-mo	2-mo	2-mo	2-mo	2-mo
1-10.....	2-mo	2-mo	2-mo	2-mo	1-mo	1-mo
1-12.....	2-mo	2-mo	1-mo	1-mo	1-mo	1-mo
1-16.....	2-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-20.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-23.....	1-mo	1-mo	1-mo	1-mo	1-mo	1-mo
1-26.....	1-mo	1-mo	1-mo	1-mo	1-mo	0
1-30.....	1-mo	1-mo	0	0	0	0
1-35.....	1-mo	0	0	0	0	0
1-40.....	0	0	0	0	0	0

ODOR THRESHOLD NUMBERS

Cold	13	11	11	11	9	9
Hot	36	31	27	27	27	24

TABLE IV—TEST OF ATLAS BLEACHING CLAY ON A WATER SUPPLY LOCATED IN THE EASTERN PART OF THE UNITED STATES

Dilution	No Treatment Cold	No Treatment Hot	40 P.P.M. of Aluminum Sulfate Cold	40 P.P.M. of Aluminum Sulfate Hot	40 P.P.M. Aluminum Sulfate and 100 P.P.M. of Bleaching Clay Cold	40 P.P.M. Aluminum Sulfate and 100 P.P.M. of Bleaching Clay Hot
0	2-mo	4-mo	2-mo	4-mo	2-mo	4-mo
1-1	1-m	3-mo	1-m	3-mo	1-m	3-mo
1-2	1-m	3-mo	1-m	3-mo	1-m	3-mo
1-3	0	2-mo	0	2-mo	0	2-mo
1-5		2-mo	..	2-mo	..	2-mo
1-8		1-m	..	1-m	..	1-m
1-12..... ..		1-m	..	1-m	..	1-m
1-15..... ..		0	..	0	..	0
Odor threshold	3	13	3	13	3	13

Table III gives the results of tests on diluted oil refinery wastes. The refinery waste was collected from the sewer of an oil refinery, and had a very strong oily, gasoline and musty odor. The waste was diluted with 100 parts of Lake Michigan water, which gave a solution with a hot-odor threshold of 36. These tests show very slight odor reduction by use of the bleaching clay. As the water at Whiting, Indiana, is thought to be highly polluted with oil refinery wastes, it was to be expected that the results on the lake water and the diluted refinery waste would show similar results.

Atlas Bleaching Clay was tried on a sample of water from one of the cities in the eastern part of the United States in an attempt to remove a musty and oily odor. Table IV shows that the clay did not give any detectable reduction of the odor. One portion of the water received no treatment, except that it was stirred for one hour, filtered through a plug of cotton just as was the treated samples. The second sample was treated with 40 p.p.m. of aluminum sulfate and was filtered through cotton. The third sample was treated with 100 p.p.m. of bleaching clay and 40 p.p.m. of aluminum sulfate. Neither the aluminum sulfate nor the bleaching clay produced any appreciable reduction in the odor.

Conclusions

From these few tests, the writer is of the opinion that bleaching clays for taste and odor removal will have a very limited value. It is worthy of consideration, however, for adding to fairly clear water to produce an artificial turbidity when it is desirable to settle microörganisms out of the water before it reaches the filters.

It is believed from the results secured that the samples of bleaching clays which were tried have an odor adsorption value, for the particular odors involved, which is less than 2 per cent of that of a good grade of activated carbon.

REFERENCES

[1]Norcom, Geo. D. Bleaching Clay in Water Purification, Water Works and Sewerage, 80; 53-4, February, 1933.

Posthumous Carnegie Award to E. I. Roberts

E. I. Roberts, who lost his life at the Lima (Ohio) Sewage Treatment Plant on May 4, 1932, in an attempt to rescue the plant superintendent, who had become overcome from sludge gas, was awarded the Carnegie Medal posthumously. Mrs. Roberts received the medal and award. Mr. Roberts at the time of his death was connected with H. P. Jones, Consulting Engineer of Toledo, who was the designer and supervisor of the new Lima plant. Prior to that he had served the State Department of Health, which recommended to the Carnegie Hero Fund Commission, the making of the award.

THE 53RD ANNUAL CONVENTION OF THE AMERICAN WATER WORKS ASSOCIATION

(Continued)

THE July issue of WATER WORKS AND SEWERAGE contained the first installment of this report covering activities and papers read during the 53rd Annual Convention of the American Water Works Association held in Chicago June 12th-16th. Now follows the second installment. The concluding installment will be devoted to the reporting of the Symposium on Cement Linings for Water Mains and Fittings.*

Montana Section Wins New Membership Award

The Nicholas S. Hill Cup, awarded each year to the local section of the Association which gains the greatest number of new members, was announced by President Pracy as having been won for 1932-1933 by the Montana Section (H. B. Foote, Secretary). The cup was received by Wade Plummer, Superintendent of the Butte Water Company, who was Chairman of the Montana Section during the past year. The California and the Canadian Sections were second and third in per cent gain of new members.

Public Relations and Advertising the Water Department

Something of a novelty, was the appearance of a charming young lady on the program in the person of Miss ELIZABETH SYMMS, who is Public Relations Counselor of the Indianapolis Water Company. Miss Symms spoke before the Plant Management Division on the topic of **"Introducing Your 'New' Consumer."** She said that much depended upon the treatment received by new consumers as to their reaction toward the Water Department and, therefore, the good will of the community. She spoke of the Superintendent or Manager of a Water Department as being basically a merchant of the highest order with a precious commodity—wholesome and utilitarian water—for sale. But she counselled that there was more: The Superintendent who failed to sell "service" along with the water would be "faced with the dark days ahead." Hard working Superintendents, she said, were but little appreciated because of the lack of advertising and merchandising the service as well as the commodity that his Department had to sell. A little thought to publicity would reveal many ways of showing the consumers what they were getting for their money,—the interesting and romantic side of the water business had a genuine appeal to the public. Just the matter of stressing the coöperation between the State Department of Health and the Water Department possessed a distinct appeal and she would venture to suggest as the publicity slogan for 1933—"A life insurance policy with every drink of water!" Another matter was the very cheapness of such a valuable and important commodity as water is. What of greater value could be purchased for as little as 8 cents for a ton? The simple truth attractively told will always meet unfair propaganda and the intelligent recognition of each home in the community will bear fruit in building the sort of public relations that makes for happy consumers and an appreciated Water Department. Friendliness, efficiency and courtesy were three essentials in successful marketing of water and in the effective "selling" of the Water Department.

FRANK JORDAN, Secretary of the Indianapolis Water Company, told of the excellent results which had been attained through Miss Symms' public relations work. He thought that water works men were "just a little lame" in matters referred to in Miss Symms' talk—particularly in respect to telling the consumer about the water supply and what the Water Department is doing, has done, or is going to do to better the service or product. Water was considered far too commonplace for the best interest of the business and he thought there must be something that the Association might do toward placing the water supply business on a higher plane.

THEODORE A. LEISEN, General Manager, Metropolitan Utilities, Omaha, Neb., referred to some advertising done by them calling attention to water for lawn sprinkling at a cost of 4 cents per ton for beautifying homes and thereby the city. Two days later the consumption had risen from 26 M.G.D. to 44 M.G.D.

A. U. SANDERSON, of Toronto, felt that time and effort put in on engineering had been too great in comparison with that of publicity, which was another way of saying that "the factory" was highly efficient but the "sales department" had been neglected.

THOMAS WIGGIN, Chief Engineer of the Federal Water Service Company, said that publicity by private water companies was likely to be looked upon as propaganda unless carefully done.

Other members cited schemes employed to interest the public in the local water department. One included leakage demonstrations in the office window of the Water Department and a guessing contest as to the gallons represented in one month by streams of varying volumes. This was staged at Waukesha, Wis., and the reward to the winner was free water for 3 months.

A. C. KAMPLAIN, Secretary of the Water Board of Valparaiso, Ind., agreed heartily with the idea of advertising the Water Department and its product—saying that it would benefit the public and the city as well as the Water Department.

Descriptive Talk on Manufacture of Concrete Pipe

The manufacture and laying of Lock Joint concrete pipe was described by COL. FRANK F. LONGLEY, who gave the talk with the aid of extremely clear motion pictures.

In discussing the values of Lock Joint pipe, C. J. DESBAILLETS, Chief Engineer of the Montreal (Canada) Water Department, related some experiences with this type of pipe wherein a 14-mile line had been laid through mountainous terrain. Great satisfaction had been had with the pipe and the reasons for its selection over other materials had proven to be well grounded ones. After 17 years the capacity of the line had gained rather than decreased. Steel cut out of a section was still blue and each joint in the line served as an expansion joint.

Discussion of Pipe Coatings

"Bituminous Pipe Coatings"—W. M. WALLACE, Superintendent of Filtration, and JAS. A. PARKS, Senior Chemist, Department of Water Supply, Detroit, Mich.

*Papers and discussions presented as part of the Symposium on "Cement Lining of Water Mains and Pipe" have been reproduced in mimeographed form by the American Water Works Association. It may be possible, therefore, to procure a copy from the Secretary's office.—Editor.

This paper, presented by the senior author, discussed corrosion and its prevention; relative merits of asphalt vs. coal tar base coatings; methods of making field tests and laboratory tests and specifications as tentatively adopted by the Detroit Water Department for hot dip and cold application. The opinion of the authors appeared to favor air-blown asphalt as the most satisfactory coating material. Mr. Wallace explained that they had felt there was room for improvement in the tests evolved and in the specifications arrived at and therefore criticism and suggestion were invited.

J. M. Evans, of the Johns-Manville Company, reported on some tests applied to pipe coatings in connection with studies undertaken by the U. S. Bureau of Standards in which the Johns-Manville Company had coöperated. Coal-tar had been found superior to other coatings. In testing coatings the important consideration seemed to be moisture absorption and electrical conductivity.

Leonard P. Wood, Engineer of Design, Board of Water Supply, New York City, and also Chairman of the A. W. W. A. Committee on Corrosion and Protective Coatings for Pipe, in a clear-cut statement said that nothing had been found to favor asphalt coatings over coal-tar. Asphalt in fact lacks adhesive qualities possessed by coal-tar and also absorbs water to a greater extent—a bad feature. After 17 years of tests in New York City coal-tar had appeared superior. Cement had been satisfactory during 50 years of service and coal-tar enamel had been satisfactory after 78 years of service.

"Modern Methods of Lining and Coating Pipe"—Linden Stuart, President, Wailes Dove-Hermiston Corporation, of New York City.

Mr. Stuart commented on the 19 years of good service given by a 1/32 inch coating of bitumastic enamel which had been applied by hand brushing on a steel pipe line in New York City. Tests on pipe coated with bitumastic enamel show that the coefficient "C" in the Hazen Williams formula for pipe line carrying capacity had varied from 144 to 167 on 10 to 30 inch diameter pipe. During recent years considerable attention had been given to exterior coating of steel pipe. A wrapping of reinforced cement mortar over bitumastic enamel was now indicated as the most satisfactory scheme. The largest and longest line to employ such a method of protection was represented on the Hetch-Hetchy project for San Francisco, wherein 25 miles of 56 to 66 inch steel pipe was so protected.

In connection with coated cast iron pipe he suggested care in pouring joints if lead be used rather than a lead substitute. The lead should not be poured hotter than 800° F. in order to prevent softening and dripping away of the enamel coating near the bell.

L. W. Stocker, Senior Engineer of the San Francisco Utilities Commission, presented a discussion which was read by Mr. Pracy—accompanying this, motion pictures of the pipe coating scheme used on the Hetch-Hetchy line were shown in which the pipe is coated in the field as laid.

Electrolysis of Water Service Piping

In opening the discussion of the electrolytic attack and destruction of house service lines and meter bottoms by the action of stray electric currents from grounded lines, Nicholas S. Hill, Jr., Consulting Engineer, New York City, pointed to some rather definite findings in connection with investigations made recently. Experiences of the Hackensack Water Company, he said, had shown that alternating current, contrary to assumption, was responsible for electrolysis but not so pronouncedly as was direct current. Infinitesimal currents seemed to produce damaging effects through galvanic action, causing complaints from coloration and a taste created in the water. Many meter bottoms had been badly attacked to the extent that enameling of meter parts is being considered. (As Chairman of the A. W. W. A. Committee on Electrolysis, Mr. Hill invites coöperation of others in making studies of the effect of minute currents on water services and meters—and methods of combating the trouble.—*Editor.*)

M. W. Cowles, Sanitary Engineer, Hackensack Water Company, New Milford, N. J., went somewhat into detailed description of the investigations made which seemed to point conclusively to discoloration and metallic taste having been caused by slight electrolytic effect—this even when as little as 1 to 2 amperes of current flow had been detected. In some cases a bad odor had also been imparted to the water. Specimens of attacked pipe and meters were exhibited.

D. A. Heffernan, Superintendent of the Milton (Mass.) Water Department, supported Mr. Cowles' contentions by citing a case of electrolysis which had caused the water meter to be attacked and thereby copper to be passed to the consumer to the extent that sponges and tooth brushes turned green. An insulated joint between meter and service had corrected the trouble. It was a case where a wire had been grounded through the household water piping.

Second Superintendent's Round Table

H. F. Bloomquist presiding.

"Quick Closing Valves for Isolating Breaks in Large Mains"—W. W. Brush, Chief Engineer, Department of Water Supply, New York City.

Mr. Brush said that with emergency gangs equipped with valve closing trucks in all five Boroughs of New York, 30 minutes was required to get the gang to the valves under best circumstances. If closed by hand, it takes 25 to 40 minutes to actually complete the closing of large gates. He said that valves were installed on the Catskill system gate chambers which closed automatically when flow rates increase beyond a normal point. He felt for several reasons that it would be hazardous to put such valves on the distribution system and that a balanced type quick closing valve is highly desirable. He thought, however, that such valves should be subject to closing electrically by throwing switches located at strategic points. Automatic valves might cut out important sections of the system during a heavy fire draught and therefore the manually controlled, electrically operated type was more trustworthy.

S. Logan Kerr, of the Baldwin-Southwark Corporation, of Philadelphia, Pa., at the suggestion of Mr. Brush, outlined some of the essentials of quick closing valves of recently improved design which would close whenever abnormal flow velocities took place in either direction through the valve. He said that such valves should not close too quickly and thus create hammer. He believed that 5 minutes closing time should be required on the average and even 10 minutes would be better in certain cases.

Mr. Brush agreed that 10 minutes was sufficiently fast closing for safety. In reply to a question Mr. Brush said that all valves above 20 inch size should be equipped with bypasses, kept open to facilitate ease of closing.

J. B. Eddy, of Chicago, reported damages from too quick closing of automatic valves. Hammer pressure on a 24-inch line had built up to 200 lbs. from the 35 lbs. carried on the line. Automatic Cone Valves were being used at pumping stations with considerable satisfaction.

W. P. WELDON, of Chicago, said that it was advantageous to use smaller valves than the main diameter—24-inch valves being used on 36-inch mains.

MR. BRUSH stated that New York's practice had been to use 20-inch valves on 20 to 30-inch mains, 36-inch valves on mains of 36 to 60 inch and 48-inch valves on 60-inch mains. "Wire-drawing" created by high velocities through the open valves had been prevented by use of reducers 6 feet long on the down stream side of the valves. "Chattering" had been noticed but without apparent damage to the valve.

In reply to a question as to the type of valve closing equipment employed, Mr. Brush replied that the Clark type of equipment was employed on the side of the trucks but these had been modified slightly to center more readily. The motor operates the mechanism through gears on the drive shaft.

"The Value of Continuous Pressure Recorders at Various Points on a Distribution System"—J. B. EDDY, Engineer of Water Pipe Extensions, Chicago.

Mr. Eddy's paper was presented by W. P. Weldon, of the same department. In Chicago there are 65 pressure recorders located at important points on the distribution system, including 12 pumping stations. Daily charts are mailed in to the central office for examination and recording on weekly charts. The system had been responsible for improved service and saving in pumping costs. Noting a too high build up of pressures at night it was found practicable and money saving to reduce the number of pumping stations in service at night and yet maintain the 25 lbs. pressure normally required for good service.

Several different makes of recording instruments had been employed with equal degree of satisfaction. The minimum pressure carried in residential districts was 12 lbs. per square inch.

In reply to a question as to the satisfaction from such low pressures, Mr. Weldon replied that 25 lbs. was sufficient for 4-story buildings. Apartment houses and industrial establishments employed booster pumps to produce the pressure desired.

S. B. NELSON told of a similar scheme of pressure recording used in New York City, and MR. BRUSH added that he believed the electrical transmission of pressure readings from points on the system to a recording device in central offices was a highly desirable scheme and would become common practice in the future. Their plans included that of using telephone lines for transmission by the telemetering principle. In New York pressures of 30 to 35 lbs. had not been satisfactory on the whole.

E. A. MUNYAN, of Cincinnati, O., said that they were transmitting pressures over 12 miles of telephone wire to the central office and the service had been excellent.

One member reported use of 2.5 miles of telephone line for which the charges by the telephone company had been $10.80 per month.

At Kalamazoo, Mich., the charges for telemetering service had been $5.00 per mile of phone line used per month.

"Inspection and Control of Sprinkler Systems"—J. ARTHUR JENSEN, Supervisor, Water Department, Minneapolis, Minn.

Mr. Jensen said that connection of a privately owned fire protection sprinkler system to the public supply was a special concession and, therefore, subject to special control. It is desirous to have separate connections for the regular service and special services such as fire supply and sprinkler systems and check-ups must be made to detect any consumption through the fire service usually by installation of detector meters in conjunction with the approved double check valve arrangement. The systematic inspections required of such equipment was rightly a service for which there should be a charge to be borne by the consumer served. Such is the extent of the service to be expected of the water company or water department.

Answering a question as to what penalty was applied for the mis-use of fire service connections, Mr. Jensen said that a fine of $100.00 was imposed.

Reporting on Kalamazoo practice a representative said that a rate 3 times the ordinary rate was charged for water used through a fire connection for other than fire purposes.

T. J. SKINKER said that the St. Louis charge was $5.00 per year for connections of 3 inch to 12 inch. In the case of sprinkler systems there is a seal on the line and it is inspected monthly. In addition a connection to an alarm system must be made to detect usage or else the service must be metered at the consumer's expense.

F. B. MCDOWELL reported that Charleston, S. C., makes a charge of $50.00 per year for connections to sprinkler systems. The St. Paul, Minn., practice was to require the posting of bond against illegal water takings. The flat charge was $50.00 per year for 6-inch service or $25.00 for 4-inch line.

"Control of the Size of Consumers' Services"—W. W. MOOREHOUSE, Director, Water Works and Sewerage, Dayton, O.

Mr. Moorehouse pointed out that one problem of the moment, facing the Water Works managers, was the control of size of services to meet the needs of the consumer rather than his ideas of what size the pipe should be. It was difficult to make hard and fast rules. The prevailing pressures on the mains at various points would largely determine the size of service to be required and private fire protection service was the greatest bug bear to superintendents. The real opportunity to control the size of service was that of setting a meter of proper size regardless of service pipe diameter. Properly graded installation and ready-to-serve charges, increasing with size of service, will materially aid in keeping down the insistence for sizes larger than actually needed.

G. C. STOREY, of Windsor, Ont., thought that the customer should be pleased and charged accordingly. Sudden draughts, even through a 6-inch line, should not disturb properly designed systems.

E. F. DUGGER, of Newport News, Va., agreed with Mr. Storey and their practice was to go to oversize rather than risk too small services where the consumer wished the larger within reason.

D. A. HEFFERNAN, of Milton, Mass., said that service pipe material was an important item. To adequately supply a home with flushometer toilet valves a 1¼-inch service was needed. He thought that water departments should have the say relative to size of service pipe all the way to the building rather than just to the property lines. Milton practice was to require cement lined 1-inch service pipe, as the minimum size, all the way to the building. Smaller sizes should be considered out of date. Galvanic action would set up where metals dissimilar were joined, so he favored control of the material as well as sizes of service pipes, advocating 1 inch and larger.

J. E. GIBSON said that architects, plumbers and builders needed more instruction relative to size of piping in their buildings as well as the service pipe. The idea of saving a penny on pipe sizes had cost water departments much misery and explaining as to why the service was

poor. After all the available pressure at the main was the important element in determining service pipe sizes.

T. J. SKINNER referred to a valuable booklet issued by the Indianapolis Water Company which was prepared for the instruction of architects, builders and plumbers as to water pipe sizes best to employ under various conditions. It was a highly useful publication, and he would recommend it.

"The Selection of Service Pipe Materials"—W. A. PEIRCE, Manager, Water Department, Racine, Wis.

Mr. Peirce reviewed the practice and experience of various water works managers in respect to the materials employed for house service lines. A questionnaire had been sent out to representative cities, replies to which had been received from 65 municipal water works and 14 water companies.

It was indicated that the practice of municipally operated water departments in making new service connections, to be as follows:

23 per cent make the tap and corporation cock is inserted but nothing more.
37 per cent run the service to the curb line.
34 per cent run the service to the property line or the meter.

The services are owned by the water department in 56 per cent of the cases and 67 per cent maintain part if not all of it.

Of the private water companies:

21 per cent make the tap only.
14 per cent carry the service to the curb.
65 per cent carry the service to the property line or meter.

Seventy-two per cent of the water companies own the service piping and 86 per cent maintain part if not all of the service line.

The survey had indicated that 50 per cent of those replying made use of ¾-inch copper service pipe or tubing and that the price of materials had not been a deciding factor in 71 out of the 89 cases. The copper pipe, so extensively used, had been just 60 per cent in 1933 of the cost of the same material in 1929. Lowest maintenance and repair costs had been the criterion in selection of service material rather than the cost price. From that it could be concluded that the best material was being employed regardless of price differential. He had found that temporary aid had been given many owners faced with the expense of repairing or renewing services recently.

J. E. GIBSON thought it time for water works managers to get away from the first cost complex. Being an expensive job to dig up service pipe and cut through paving and repair it, he stressed the false economy of using materials for services which have a doubtful life. In buying service pipe he had learned that "you get just about what you pay for."

Should the State Regulate Water Rates Charged by Municipal Plants?

A nice question was discussed by A. B. MCCRUM, Secretary of the Public Utilities Association, Charleston, W. Va. In his paper, **"State Regulation of Water Rates for Municipal Plants,"** Mr. McCrum touched on a topic of considerable importance and one which deserves a deal of consideration and thought.

Believing that Public Utility Commissions should have powers to regulate the municipal water works business, just as it does privately owned utilities, and as now so successfully practiced in Wisconsin, Mr. McCrum said that, "it is time for state executives, taxpayers and water consumers to awaken to the fact that State regulation of municipally owned water works systems is in the public interest—that is, it is a protection to consumer, taxpayer and honest efficient plant operators." Only one thing appeared to interfere, and that was political interests.

Seventy-two per cent of the water systems in the U. S. A., he said, were municipally owned. In the states of Maine, Nevada, Wyoming, Wisconsin and West Virginia the State Utility Commissions had fairly complete control over municipal plants. Rightly, a water plant was a utility and as such, the municipality operating a water works was in the business of supplying water and was not acting in its governmental capacity in this matter. The consumer (not necessarily the taxpayer) he thought, should not be required to pay more, and should not be allowed to pay less, than the *actual* cost of the service he received. It had been, as is too often the case, that water rates had been fixed to meet political expediency with no sound reasoning involved just in order to juggle funds. In some municipalities the income from water sales had been used to defray expenses of other municipal ventures. In others, the taxpayer contributes to the deficiency to be met in operating the water system. Either scheme, he claimed, was basically unsound, wrong and unfair.

E. E. BANKSON, Consulting Engineer, Pittsburgh, Pa., and Chairman-Elect of the Finance and Accounting Division of the Association, rather preferred to take a middle-ground stand between the arguments of Messrs. McCrum and Morris. He was particularly enamored with the idea of a uniform classification of accounts. Being actively engaged in evaluation and rate making he could appreciate much of Mr. McCrum's argument for Commission regulation. The Chicago practice was one which should have been relegated to the scrap heap long ago and would not be tolerated under regulation.

Referring to a comment by Mr. Morris to the effect that sufficient surplus was maintained for ordinary extensions, he recalled the situation at Erie, Pa. There ordinary plant extensions were provided from current revenues. Analysis had indicated that ordinary extensions had been equivalent to about 6 per cent return on the plant investment. In consulting practice, he had always taken the position that municipal rates were not excessive as long as these did not provide more than a fair return on the entire plant value (not the outstanding indebtedness alone)—the same as for private utilities.

Progress in Water Treatment

The last session of the Convention represented a joint meeting of the General Membership and the Water Purification Division and was presided over by J. W. Ellms, Chairman of the latter.

"Progress in Water Purification" was reviewed by GEO. W. FULLER of New York City.

Mr. Fuller, as the result of 43 years of close contact with water purification developments and to a major degree responsible for much of the progress made, was well qualified to present the comprehensive review which he had prepared on that topic, which began with the introduction of the earliest slow sand filters of Chelsea, Eng., in 1829 and coming up to date through the 104 intervening years.

Mr. Fuller thought that water purification in America could be dated from 1869 when Kirkwood made his report to St. Louis calling attention to the need of water purification. The period 1869-1886 represented that of the beginnings; 1886-1903, that of fundamental research and experimentation; 1903-1918, that of rapid developments and 1918-1933, that of refinements and extensions.

Mr. Fuller reminded his listeners that rapid sand filters were first used in paper mills—the English (Hyatt) pressure type filters being installed at a mill in Somerville, N. J., in 1885 and that Atlanta, Ga., in 1887 was the first city to adopt rapid filtration.—(These were also Hyatt filters filled with charcoal and sand. While not in use, these units are still in place at the Atlanta Filtration Plant.—*Editor.*) Then followed Chattanooga, Denver and New Orleans.

The period of fundamental research, 1886-1903, was characterized by lack of jealousy between engineers and chemists—the first Lawrence Experimental Station report being issued in 1890. It was in 1895 that the studies of rapid sand filters at Louisville opened up the possibilities of this type of filter. The use of chemicals added to coagulate water was frowned upon by medical men and progress with coagulants had been thereby delayed.

The "Golden Age of Accomplishment" (1903-1918) followed the building of the gravity filtration plant at Little Falls, N. J., in 1902, when patent controversies led to the design of filtration plants by engineers. Chlorination was introduced in 1908 and water softening was introduced at Winnipeg, Canada, and shortly after that at Oberlin, O. There was a better understanding of coagulation and the pH concept appeared. Then came the period of refinements (1919-1933) in which mechanical coagulation and better flocculation equipment appeared to produce better clarification.

A better understanding of the use of chlorine in a great variety of ways appeared, including super and dechlorination and the use of ammoniation and activated carbon for taste removal or prevention. Iron and manganese removal was perfected and in softening practice recarbonation came into practice to increase the efficiency of that process. Corrosion control was introduced by raising the alkalinity (pH) of the finished water. The use of zeolitic softening was perfected. Aeration progressed and large filtration plants were constructed at Buffalo, Cleveland and Detroit. And today 31 million people in America are supplied with pure and wholesome filtered water—some of it being softened as well. The battle against tastes and odors continues and that problem, not yet completely solved, seems fair to become so with continued and increased attack.

JOHN R. BAYLIS rose to review and praise the brilliant record of Mr. Fuller during the period of 1890-1897 when boldness was required in the matter of water purification development—particularly in respect to his rapid sand filter work at Louisville which led to the classic report of 1897. Mr. Baylis thought that the beginning of chlorination in 1908, in which Mr. Fuller also had a hand, marked the opening of a new epoch, and that the odor and taste eradication work, begun intensively in 1930, would be considered as a real advance later on when looking back.

L. H. ENSLOW said that he also agreed that 1908 was an important year in water purification developments but that the record should show that chlorination of water had been really established in 1902 by Dr. Duyk at Middlekerke, Belgium. The use of such a powerful chemical had been apparently frowned upon by water authorities in America until 1908 when chlorine was first used as a sterilizer of potable waters. The late Geo. C. Whipple had seen the Middlekerke process in use and was impressed by it sufficiently to deliver a talk on this development before this Association in 1906, and printed in the Proceedings of the American Water Works Association for that year—four years after Duyk had perfected it. Interestingly the Middlekerke filtration scheme employed ferric iron coagulation and prechlorination. The chlorine application in the form of bleaching powder (chlorinated lime) was controlled by making titrations of water samples to maintain a minute excess (residual) chlorine content in the finished water.

Industrial Water Treatment

SHEPPARD T. POWELL, Consulting Chemical Engineer of Baltimore, Md., and Chairman of the Joint Committee on Boiler Feed Water Studies, made a report in the nature of a paper read in his absence by F. G. Straub of the Chemical Engineering Department at the University of Illinois.

Mr. Powell's paper called attention to the research fellowships established at the Universities of Michigan, Ohio and Illinois to study methods of improving industrial water treatment for steam production. This had been the outgrowth of the work of the Boiler Feed Water Studies Committee. Studies were actively going on looking to the solving of boiler metal embrittlement due to high hydrate and low sulphate content of the water in the boiler. He pointed out the slight value of chemical analyses of scale as compared with petrographic analyses which revealed the mineralogic nature and formation of scales—an interesting one being Analcite, which is a silicate with properties similar to zeolite. Lantern slides were employed to picturize metal embrittlement and various scale depositions. For examination of boiler metal the Morrison Magniscope had been most helpful, he said, and its use was demonstrated by lantern slides.

The purification of steam was another important matter because even as low as 1 p.p.m. total solids in steam would create depositions on turbine blades and had created trouble. As much as 2 p.p.m. created a loss of $100,000 per year in turbine operation because of necessary shut downs and "washing" of the turbine impellers. Steam under such circumstances had to be scrubbed by clean water until it had no residual conductivity after condensation.

Much more work remained to be done and chemical methods applicable to ordinary analyses of water had to be revised or further refined for use in steam production practice. Silica, for example, must be determined in quantities under 1 p.p.m. and oxygen at even lower concentration.

CLARENCE R. KNOWLES, Superintendent of Water Service, Illinois Central Railway, Chicago, opened the discussion by reviewing progress made in water treatment for use in locomotive boilers. He pointed out that softening had saved the railways much more money than mere saving of coal. Locomotives at one time could only make 100-mile runs but now 1,000-mile runs were not unusual. There existed further need of research in softening practice and a coagulant which would also soften was something worth searching for.

R. C. BARDWELL, Superintendent of Water Supply, Chesapeake and Ohio Railway, Richmond, Va., indicated the need for continued studies of boiler water treatment but indicated the progress made in the railroad field by saying that engines could be kept in service now 2 years longer than past limits set by the Government Inspection Bureau had allowed.

"The Economic Effects of Water Quality in Reference to Soap Consumption"—H. W. HUDSON, Economist, University of Illinois, Urbana, Ill.

Mr. Hudson based his report of expected reductions in soap consumption by water softening on the findings in actural survey of soap sales in municipalities before and after water softening had been introduced. He had

found the cost of municipal softening to be less than that of operating individual household, hotel and laundry softeners. Chicago Heights water users, for instance, had spent $83,000 less for soap during the first year of water softening. Mr. Hudson offered and explained a formula for determining the economical limit of water softening.

A. M. BUSWELL said that these studies had indicated that it was both practical and economically sound to soften water to a residual of 75 p.p.m. total soap hardness.

Work of the State Sanitary Engineer

The subject of a paper by E. S. TISDALE, Chief Engineer of the West Virginia State Department of Health, was **"The Work of the State Sanitary Engineer."** It was read by Professor L. V. Carpenter of the University of West Virginia.

Mr. Tisdale reviewed some of the most conspicuous work of leading State Sanitary Engineers in the past—many having served in these positions for more than 25 years. He pointed out the coöperative work of the several associations of State Sanitary Engineers with a common interest at heart—such as the accomplishments of the Ohio River Board of State Sanitary Engineers and the similar Great Lakes Board. Such team work had been responsible for reduction of the industrial waste load on the Ohio River and other waterways. The success of the endeavors of the State Engineer's Department in respect to control of water supply and pollution hinged on coöperation and friendliness and mutual understanding. The day of police duty of State Sanitary Engineers had passed forever and in place of it had sprung up a desire to help those in charge of water supply and sewerage. That such would bear fruit has been amply demonstrated in recent years and during emergencies in particular.

L. H. ENSLOW in discussion said that he had had experience in the Sanitary Engineering Divisions of two states and had also been in charge of municipal water plants, so he could speak from a divergent point of view. He had since worked in close coöperation with a number of State Sanitary Engineers and their staff members and could verify all that Mr. Tisdale had said about the willingness of these men to help wherever help was needed. He had had opportunity to observe the value of these men to water works and sewerage operators—particularly in times of need and emergencies. And that they were worthy friends and efficient and conscientious workers.

L. F. WARRICK, Chief Engineer, State Department of Health of Wisconsin, stressed the need for thorough and genuine coöperation if the State Sanitary Engineer was to be of maximum value and help to water works and sewerage men. He pointed out how effectively the work of correcting stream pollution could be carried forward with benefit to industry frequently resulting through coöperative efforts. He cited the case of paper mills which had learned that stream pollution was dead waste when reuse of the "white-water" had been perfected through coöperative efforts. (Elsewhere in this issue there appears an article by C. M. Baker, former Sanitary Engineer of the Wisconsin State Department of Health, which described the process of white-water reuse designed to save money and minimize stream pollution.—*Editor.*)

The Water Works Laboratory as a Public Relations Asset

In his paper, **"The Public Relations Value of the Water Works Laboratory"**—HARRY E. JORDAN, Sanitary Engineer, Indianapolis Water Company, said that the first duty of the water works laboratory was that of insuring that a safe and satisfactory water be delivered to the consumers, but the laboratory man must also learn the value of happy relations with the public. He should, therefore, "come out of the kitchen" and know the consumer's side of the water supply business. He should, above all, appreciate the value of diplomacy and encourage even the inquisitive visitor at the plant. Consumers having some special problem in water usage should receive the help of the laboratory and its attention to complaints—real or imaginary.

In the case of checking up on the quality of supplies cross-connected with the public water system and in the matter of inspecting cross-connections, as required by the U. S. Public Health Service, there would be resentment on the part of the owners unless the laboratory man used judgment and diplomatic methods. Those in charge of laboratories or plants should have the respect of the community, but an untidy appearance of person or surroundings would soon defeat that. Complaints, such as the killing of tropical or gold fish by the public water, seemed to be illy grounded, according to the magazine "Aquarium" but they were complaints needing careful handling and constituted a difficult phase of public relations. Mr. Jordan said that chlorine in the water was frequently blamed for fish killing but is in reality of less importance to the lives of fish than is generally believed.

One highly important job of the purification plant manager was to see that one or more employees are trained to present an easily understood story of what the various plant units accomplish and what the laboratory is doing to maintain a safe and palatable water supply. The visitor hearing such an explanation would be impressed and feel a kindly interest in the utility as a result.

I. M. GLACE, District Engineer, Pennsylvania State Department of Health, felt that instructing visitors to plants was indeed an important duty of the plant management. "No Admittance" signs had no place at water works plants but surprisingly some had not yet been torn down and "Welcome" signs put up instead. He thought that publicity was the weakest asset the laboratory man possessed because its value had not been sufficiently recognized. The use of newspaper articles to inform the public as to the cause of tastes and odors and of attempts made toward the eradication of tastes and odors was a valuable means of procuring the understanding and sympathy of consumers.

Someone asked a question concerning the relative mortality of gold fish form ordinary chlorine treatment vs. the use of ammonia-chlorine treatment.

L. H. ENSLOW replied that an early assumption, that the residual chlorine carried out into the system when ammonia-chlorine treatment was introduced, had resulted in high gold fish mortality, had been proven not to hold. There had been reports that the residual chlorine in that form had even been helpful to pet fish by keeping down a slime like growth which appears on the fish at times. At sewage plants gold fish had been kept in tanks supplied by chlorinated sewage plant effluent carrying a variable residual chlorine content.

J. J. HINMAN pointed out that other things, such as temperature change shock, would kill gold fish.

After the awarding of the Nicholas S. Hill New Membership Cup to the Montana Section, the Convention was adjourned.

Note.—The Symposium on Cement Linings for Pipe and Fittings will be covered in the September issue.—*Editor.*

Important Statement of National Recovery Committee for Water Works Construction

THE following statement has been issued from the offices of the American Water Works Association by its National Recovery Committee for Water Works Construction. It is considered of sufficient importance to justify reproduction in these columns.

THE STATEMENT

It has come to the attention of this Committee that there is sentiment in a few communities of the nation against incurring any additional indebtedness to undertake the construction now of needed public facilities as part of the National Industrial Recovery Plan. This is due in great measure to the feeling that there is a marked betterment in industrial activity and the hope that it will, therefore, not be necessary to expend money on construction work.

There is also criticism of the provision in the National Industrial Recovery Act for a Federal grant of 30 per cent of the cost of labor and materials, on the assumption that this is actually a gift of Federal money to the citizens of the country. Some citizens believe that communities ought not to use Federal money under these conditions for any municipal purpose.

It has also come to our attention that the extent of the benefits which will be realized by communities which co-operate in the Recovery Plan through construction of needed facilities at this time is not generally appreciated. Brief statements have, therefore, been prepared in answer to the above three points.

Proposed Program vs. Normal Program

1. The normal program of public and private construction work was, in the decade prior to the depression, approximately 8 billion dollars per year. This amounted to about 10 per cent of the aggregate national income—the total of the estimated earnings of the individuals of the country. Such construction thus afforded investments in useful facilities for those in the country who wished to save, on the average, 10 per cent of their income. Through the construction activities, therefore, these savings were immediately redistributed as purchasing power paid out for labor and materials going into new structures. At the present time it is indicated that the 1933 public and private construction program will be less than 2 billion dollars. If it is possible, through the National Industrial Recovery Act, to add 3.3 billion dollars more to this 2 billion dollars, there may be expected in the next 12 months a total construction program of only 5.3 billion dollars. This is 10 per cent of a national income of 53 billion dollars and is none too large to provide investments for savings which may be expected as the result of success of the Recovery program. Due to inevitable withdrawal, as above mentioned, of a certain proportion of individual income from industry for savings and investment purposes, the Recovery program cannot move forward without a construction program to convert these savings and investments into purchasing power. The present great upturn in manufacturing activity requires, therefore, corresponding speed in placing all 3.3 billion dollars' worth of work authorized under construction. The responsibility for speeding up construction work for approximately two of these 3.3 billions of dollars falls upon state, county and municipal bodies. Their co-operation with the government in initiating work on needed facilities is, therefore, essential to the success of the Recovery Plan.

Even if all the funds made available in the Recovery Act were to be spent on works that could be completed within one year, they would not raise construction activities to normal unless present activities in industrial and residential construction were more than doubled.

Re Federal Grant

2. The Federal grant to state, county and municipal bodies of 30 per cent of the cost of labor and materials for all work which they initiate under the Recovery Act, is not a gift of Federal funds, but is actually a rebate of part of the Federal revenue from taxes which will be collected due to the release of 3.3 billion dollars of new purchasing power. It is fairly well established that new purchasing power released through construction activities creates for every dollar paid out for construction cost an average of $20 of transactions in the first year. These transactions consist of the repeated spending of the money by the persons receiving it, one after the other. The rate of transactions falls off as time progresses and may drop to $12 in the second year and $7 in the third year. If, therefore, 3.3 billion dollars are released in new purchasing power, it will create within 12 months of the time the expenditures are made, a total of 66 billion dollars of transactions. It is well established that the national income, consisting, as explained, of the total of individual incomes, amounts on the average to 8 per cent of the total of the business transactions of the nation. The transactions resulting from a 3.3 billion dollar construction program would thus contribute to the national income in the first year 5.28 billion dollars (8 per cent of 66 billion).

There exists no method by which a relation can be predicted between national income and Federal revenue from taxes in the immediate future, but it is apparent that the national income will be materially increased if recovery continues and that the present tax laws applied to increased activities will create a marked increment in Federal revenue. If conditions result which are similar to those recorded for the year 1921, a former depression and high tax rate year, the Federal tax revenue may be expected to bear the same relation to the national income, which was 9 per cent. If this relationship should obtain in the 12 months' period following the expenditure of 3.3 billion dollars, the Federal revenue from taxes would amount to 9 per cent of the above stated 5.28 billion dollars increment in national income, or $475,000,000 in a one-year period. This return to the Federal treasury amounts to 30 per cent of $1,580,000,000. This latter amount is approximately the amount to be expended for labor and materials in a 2 billion dollar construction program which is probably greater than the public works program assigned to state, counties and municipalities eligible for the 30 per cent grant. The released purchasing power continues to bring in Federal revenue from taxes for a considerable period beyond the first year of resulting transactions. Thus the grant of 30 per cent of labor and materials is simply in the nature of a part rebate in advance from the increased Federal tax revenue resulting from the construction program.

In asking the communities to co-operate in speeding recovery, the Federal Government attempts to equalize costs and benefits by means of the 30 per cent grant. It is obvious that a community which produces none of the materials it needs in its construction program will not benefit to the full extent of the cost. Producers of the materials and of commodities purchased by the newly created purchasing power who benefit are scattered over the country as a whole. To be truly equitable, therefore, part of the construction cost should be amortized from the receipts from the income and other Federal taxes as explained above.

Benefits from Low Interest Rate

3. If national recovery is to become a fact, no commmunity can afford to neglect its opportunity to secure funds under the terms of the Recovery Act for construction now of its needed facilities. Since, on the average, a grant of 30 per cent of labor and materials amounts to a grant of 25 per cent on the total cost of a municipal project, the money to be borrowed will amount to 75 per cent of the cost. The Federal charge for interest, 4 per cent, and amortization for a 25-year period on the money loaned, 2½ per cent, amount to 6½ per cent on the money borrowed which equals 4.9 per cent on the total cost of the project. In other words, a project costing $100,000 will require annual payments for 25 years of only $4,900 to cover interest and amortization. If, however, the community fails to co-operate in the Recovery Plan, but finds it must build its needed facilities within the next few years at costs for labor and materials adjusted to 1925-26 prices, the cost of the same project may be approximately $150,000. Interest and amortization will amount to at least 7 per cent and the annual cost to the community will be $10,500 a year, more than twice the annual cost resulting from construction under the National Recovery Plan. Therefore, in addition to creating work now for many who remain unemployed, transferring them from the dole public payroll to creative work, and reducing taxes for unemployment relief, facilities which the community must construct to serve the normal demands of normal community life can be created at less than half the ordinary annual cost.

It is the hope of the Committee that this analysis of these questions may assist in impressing upon those concerned the importance of immediate commencement of the public works program with those projects which can be actively prosecuted at once. This program is aimed to accomplish the maximum employment of labor before winter and it is the duty of each community of the country to do its share.

NATIONAL RECOVERY COMMITTEE FOR WATER WORKS CONSTRUCTION: Malcolm Pirnie, Chairman; P. S. Wilson, Executive Secretary.

WASTES AND POLLUTION VS. RECOVERY FOR PROFIT

By C. M. BAKER, C. E.

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WASTE, by-product, staple; such is the evolution of many a product of industry. The wastes of yesterday are the by-products of today and the staples of tomorrow. Pollution of streams and nuisances from industrial wastes, are often the prod necessary to bring about this evolution.

The Author

Staples from Waste

Chlorine discharged into the atmosphere by the soda industry was prohibited by law in England about 1880. The gas was then absorbed by lime to form chloride of lime for which no particular use was known at the time, but later this product revolutionized the method of bleaching textiles. The one time waste became a valuable by-product and ultimately a staple.

An annual return of $400,000,000 from dyes and other products was realized by Germany from its 50 years of intensive research in the development of coal tar by-products. Gas, the original staple, is now the by-product.

A blackened desolate waste for many miles surrounded plants reducing copper ore at one time. Threatened litigation and legislation resulted in the manufacture of sulphuric acid from these waste stock gases. The financial return was not great but more than covered the cost of correcting the nuisance.

The estimated capital investment to be required for a treatment plant to purify the wastes from a corn products plant was $1,000,000. Studies leading up to utilization of the waste solved the problem with a financial return of $500,000 annually and eliminated the need for the treatment plant proposed.

The squeal of the pig is said to be the only waste from the packing industry, yet the organic material in the sewage from a large plant has been estimated to be equivalent to that from the domestic sewage of 325,000 people. The squeal of this waste is in the noisome nusiance that it creates.

Between $50,000 and $100,000 net annual return is being realized by many paper mills practicing reclamation of paper making materials from the "white water" wasted into our streams, yet millions are still being wasted by other mills because of neglect, or fallacious ideas that their mills are the exceptions to the rule.

Wastes from a pulp mill interfered with the operation of the water purification plant of a large city in the South. Treatment or utilization of the waste was necessary. Certain wastes from this mill are now being used in the manufacture of activated carbon now used extensively in water purification.

Ten years ago $160,000 was spent by a paper mill for an elaborate filtration plant to treat its wastes at an annual operating cost of nearly $45,000. Today these same wastes may be utilized in the mill with a capital expenditure not exceeding $10,000, and a net annual return of $25,000 or $30,000. Recently the installation of a similar filtration plant was advised for another mill notwithstanding recent developments in waste utilization. The State Sanitary Engineer, an up to date and rational individual, advised against the installation, however, so the plant was not constructed and waste utilization was advocated as the primary step toward abatement of stream pollution.

For 50 or 60 years studies have been made in the matter of treatment of domestic sewage, but it is only within the last decade that commercial fertilizer has been marketed and not until very recently have the gases produced from the digestion of sludge been utilized for power production and heating.

A symposium upon the subject of stream pollution and industrial wastes occupied the attention of a national organization of engineers for an entire day less than two years ago. Many prominent engineers and chemists participated in the program, yet the papers and discussions dealt principally with the treatment of waste rather than utilization within the industry itself.

Developments to date lead one to believe that the sanitary engineer is prone to consider treatment the chief solution of the pollution problem and that he loses sight of the valuable principles of utilization within the industry itself, which should be the initial and fundamental step in any such problem.

Principles of Waste Utilization

Space is not available, nor is it the purpose of this paper to discuss in detail the several methods of in-

Mr. Baker, in this article, sets forth some sound general reasoning to be considered in the solution of stream pollution problems by industries. He has had intimate contact with the matter of correcting stream pollution by the pulp and paper industry during the past six years. His position as Engineer with the American Pulp and Paper Association has made it possible for him to show paper and pulp manufacturers how to reduce waste, correct stream pollution and, therewith, increase profits. One method advocated—and proven sound in practice—is described in this article. His motto is waste utilization—first: waste treatment—last.

Prior to his service with the American Pulp and Paper Association, the author was connected with the U. S. Public Health Service and the State Departments of Health of New York and Wisconsin—functioning as Chief Engineer of the latter. His experience in the general subject of stream pollution has therefore been a broad one and has equipped him to consider the pollution problem from the view point of the sanitarian as well as the industrialist.—Editor.

dustrial waste utilization or disposal. Some general illustrations will be given, however, in connection with the presentation of certain basic principles. Factors to be taken into consideration include:

1. The mill water supply—its quantity and quality required for different purposes in the mill.
2. The industrial process, with a view of determining the manner in which the process may be altered to affect the character and quantity of waste.
3. Measurements of the volume and analysis of the character of the various classes of waste. Classification is extremely important.
4. A flow diagram showing the flow of stock or materials through the mill, the points at which fresh or clean water is used and where the different classes of wastes are discharged into the sewers or drainage system.
5. Water waste through careless operation such as leaks and failure to shut off wash-up hose. Automatic closing valves at the end of hose lines will often result in substantial savings.
6. Reduction in the volume of wastes by the reuse of the cleaner wash waters and wastes instead of using clean fresh water at all points. An example is the counter-current method of washing where clean fresh water is used only to wash the finished product and this effluent in turn is used for earlier washings of the unfinished material.
7. Modifications in the industrial process which will result in less waste, or else, will so change the character of the waste as to effect improvements.
8. Preliminary or partial treatment of the residual waste with a view of recovering by-products or re-using the recovered material in the plant. Such treatment may consist of
   (a) Separation of suspended matter by sedimentation, screening, or filtration.
   (b) Chemical treatment either to improve the efficiency of the above or remove and separate non-settling solids or chemical constituents.
   (c) Recirculation or re-use by substituting the partially treated effluent for clean fresh water used in the plant.

The basic principles outlined above probably can be illustrated best by reporting developments in the pulp and paper industry.

Sulphite waste liquor constitutes the most objectionable waste from the pulp and paper industry, and is the most difficult to handle. It contains in solution about 50 per cent of the dry weight of the wood in the form of lignins and resins. Its oxygen demand is many times greater than that of domestic sewage, being estimated for a 100 ton mill as being equivalent in some cases to the untreated sewage from 160,000 persons. Between 700 and 800 patents have been taken out to cover its utilization, but none have yet proven generally practical. In a few cases, however, where local conditions are economically favorable this waste is being recovered. More recent developments indicate that within a few years its utilization to an appreciable extent will be general practice.

Fig. 1—Waste Lime Sludge from a Sulphate Pulp Mill, the Reclamation of Which by Returning Is Practical in Many Mills

Figure 1 shows a large accumulation of lime sludge waste from a pulp mill employing the sulphate process. This material is of considerable value to farmers for the reconditioning of certain lands, but its volume is so great that unless located in a distinctly agricultural area the supply exceeds the demand. This lime sludge, however, may be collected and reburned to produce fresh lime for re-use in the process. This appears to be the most practical solution of the problem and is being practiced in many mills.

Probably the most outstanding development in the pulp and paper industry has been the reclamation of stock from the so-called "white water." Water constitutes the carriage vehicle for conveying the stock through the mill to the paper machines. The wires or screens of the machines separate the stock and leave the effluent waste or "white water" which in the past was discharged directly to the sewers. This waste contains large quantities of the fiber and other paper-making materials. Attempts were made to reclaim this stock by passing it over so-called sidehill savealls, or inclined screens (Fig. 2) of wire similar to that used on the paper machines. The efficiency of this device, however, is only 25 or 30 per cent so that the loss was still great. Improved methods resulted in the installation of filter type savealls whereon a filtering mat of stock is deposited on the wire of the rotating cylinder. These reclaim large quantities of stock, developing efficiencies as high as 90 or 95 per cent and soon pay for themselves and return a substantial dividend.

Closed System Operation

Recent developments have indicated a more practical and economical method of utilization in many mills by recirculation and re-use without savealls. To accomplish this, however, sterilization of the waste with chlorine or chloramines is necessary to prevent the growth of biological slimes within the pipe lines and vats. A typical installation based upon actual developments in a paper mill is illustrated in Fig. 3, showing the flow diagram in the mill and the revisions suggested for reclamation of the waste. The volume of waste from the mill was approximately 1,000,000 gallons daily, equivalent to 120,000 gallons per ton of finished product. This waste

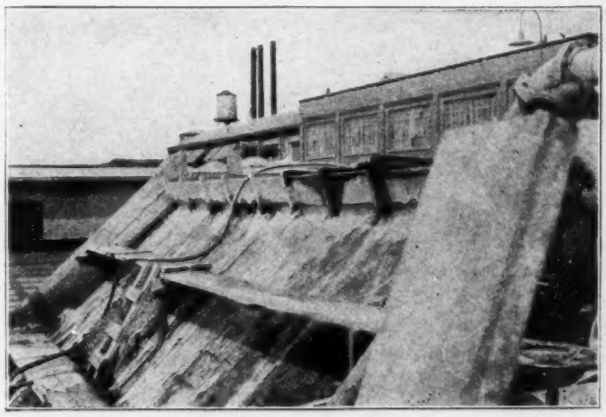


Fig. 2—Inclined Screen Saveall for Reclaiming Stock in Paper Mills

carried away nearly 7 per cent of the required stock or raw materials, and represented a loss of $85 to $90 daily. The revised flow diagram and method of operation will reduce the volume of waste to less than 10,000 gallons per ton of product and the stock loss to less than 1 per cent, resulting in a net saving of $50 or $60 daily. The water consumption will be correspondingly reduced effecting additional savings.

A description of the original flow diagram—indicated by the lighter lines in Fig 3—and method of utilization follows:

Original Practice

1. *The beaters* are furnished with lapped or dry pulp, which is diluted with clean fresh water to a consistency of about 6 per cent, then refined by beating with a rotating drum. From the beaters the stock is dropped into
2. *The beater chest,* where it is diluted with clean water or white water from a paper machine to a consistency of 3 per cent. From the chest the stock is pumped to
3. *The machine chest,* where there is no dilution. It is then pumped to
4. *The stuff chest,* whence it flows by gravity to
5. *Jordans,* where the stock is further beaten and refined and more clean water added. The stock then flows into
6. *The mixing box,* where it is diluted with returned white water from the paper machine. From the mixing box the stock is pumped to
7. *The sand table or riffler,* where sand and heavy particles settle out. From here the stock flows by gravity to
8. *Screens,* which are washed with clean water showers. From the screen the stock drops into
9. *The machine head box,* where clean water is applied through spray showers, thence onto
10. *The Fourdrinier paper machine,* where six clean fresh water showers are used to wash the wire and three to wash the felts, requiring at least 750,000 gallons of water daily.
11. *White water* from the machine may pass through the saveall but because of inadequate capacity and inefficiency little saving is effected.

All of the water entering the system ahead of the paper machine is used only for diluting the stock, to a consistency of 6 per cent in the beaters and, ultimately, about one-half per cent at the machine. Practically all of the water in the stock is removed between the head box and dry or felt end of the paper machine. Some of this "white water" is pumped back to the mixing box, but the remainder (together with that from the showers) discharges to the sewer either directly or through the saveall.

Revised Method

The revised method of utilization indicated by the heavier lines of the diagram, is as follows:

1. The "white water" is collected from the upper stretch of the wire between the head box and felts into an equalizing tank "A" from which it is pumped back for use in dilution at the beaters, beater chest, Jordans and for the showers on the screens. Approximately 5,000 gallons storage tank capacity is required to equalize the demand.
2. The "white water" from the wire showers is collected into a separate tank or sump "B" from which it is returned directly to the showers. Make-up, however, is supplied through a float controlled inlet from "B" to "A," so adjusted that it opens only when tank "A" is nearly empty.
3. The felt shower "white water" is collected in a tray and passed through the saveall, to remove threads and ravelings, into a sump "C" from which it is returned to the felt showers and also to supply "make-up" through a float controlled inlet into "B." Clean fresh water is taken into the system through a float controlled inlet into sump "C."

It will be observed that this method of operation provides for taking in fresh water only in the felt shower system and bleeding from this into the wire shower system, thence into the dilution system, thus using a minimum of fresh water.

The principal difficulty that has been encountered in the past in placing this method of recirculation (so-called closed system) in operation has been the accumulation of biological slime previously referred to, which forms in the white water system upon recirculation and re-use. This difficulty, however, is now being controlled by the

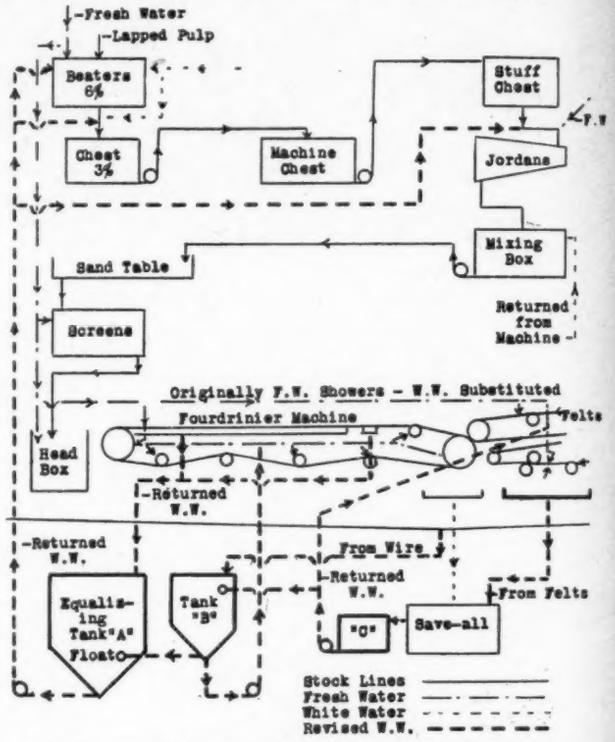


Fig. 3—Flow Diagram White Water Utilization on Paper Machine

application of the ammonia-chlorine treatment of the reused waters.

Summary and Conclusions

1. The utilization of waste within the industry constitutes the first and most important step and often the only improvement necessary in solving the problem of industrial waste disposal. This factor should be given first consideration by engineers.
2. Factors to consider in studying a problem of industrial waste disposal include the mill water supply, the industrial process, measurements of the volume and analyses of the character of the various classes of waste, the development of flow diagrams, modifications in the industrial process and preliminary or partial treatment of the waste with a view of recovering by-products or utilization of the effluents by returning them to the process.
3. White water utilization in a paper mill illustrates one of the outstanding developments in the recirculation and re-use of mill wastes, resulting in a large financial return with small capital investment and nominal operating cost.

THE PROPER ADMINISTRATION OF MUNICIPALLY-OWNED WATER UTILITIES

By MARION L. CRIST

Associate Engineer, Burns-McDonnell-Smith Engineering Co., Los Angeles, Calif.

IN far too many of the water works systems in our smaller cities there is a tendency on the part of the administrators to be "niggerly," if you please.

"Why," they ask, "if complaints about rates or service are not too numerous (there must be some, you know, if the system has any users); and why, if during the year past there has always—or at least nearly always, been money in the water fund when money was needed from the water fund, can anyone say that the water system is not doing nicely?"

And obviously, we are forced to agree, for who can say that the water system is not doing nicely? In fact, we would go even farther—who can say that it is doing nicely?

Let us not misunderstand these remarks. Public ownership has great advantages over private ownership—so great, in fact, that the publicly-owned system can suffer the ills of political management of which private owners of utilities have been known to speak from time to time, and also suffer the ills with which we are here accusing the management and still furnish water to the consumer (not the stock holder) in greater quantity, at better pressure, and for lower rates than the privately-owned water system. Suggestion for improved management, therefore, is not in the form of a panacea for a tottering industry, but rather in the same category as cod liver oil for a lusty youngster.

In the average small city in the United States the water utility is the largest, or very close to the largest single industry in the community. In even a small community of 5,000 population or less, the water business frequently exceeds $50,000 a year and involves an investment of $200,000 or $300,000. Yet, in spite of the relative size and importance of the business, very frequently investigation of the records of an operating utility discloses simply that the total amount in the water fund at the close of the fiscal year differed by a certain specific amount from that of the previous year; and, if the investigator be of a particularly inquisitive turn of mind, it may further be discovered that the "annual receipts" differed from the "annual expenditures" by this same specific amount.

Frequently there is no real breakdown of the sources of revenue, and still more frequently there is no reasonable allocation of expenditures as between direct operation, interest and principal charges, depreciation, maintenance, and enlargements and extensions. Thus all too frequently a water utility of unknown value is producing a known amount of money from unknown sources, and is spending a known amount of money on known items, but at the same time accumulating unknown assets and liabilities. Yes, we must agree! Who can say whether such a system is, or is not doing nicely?

Such systems, if they make money, do so only because it is inherently easy to do so in the water utility business. Some such systems make money until a time comes when unanticipated replacements and improvements suddenly require additional bond issues and increased taxation. Then they stop appearing to make money—at least to the taxpayers.

Division of Annual Expenses

The annual expenses involved in the business of serving a community with water through a publicly-owned system may be divided into three parts, namely—direct operating costs, fixed charges, and extensions and enlargements. These three and their principal subdivisions may be listed thus:

A—Direct Operating Costs
1. Superintendence,
2. Labor,
3. Power,
4. Clerical and Commercial,
5. Incidental Maintenance,
6. Miscellaneous.

B—Fixed Charges
1. Bond Interest,
2. Bond Retirement,
3. Depreciation.

C—Extensions and Enlargements.

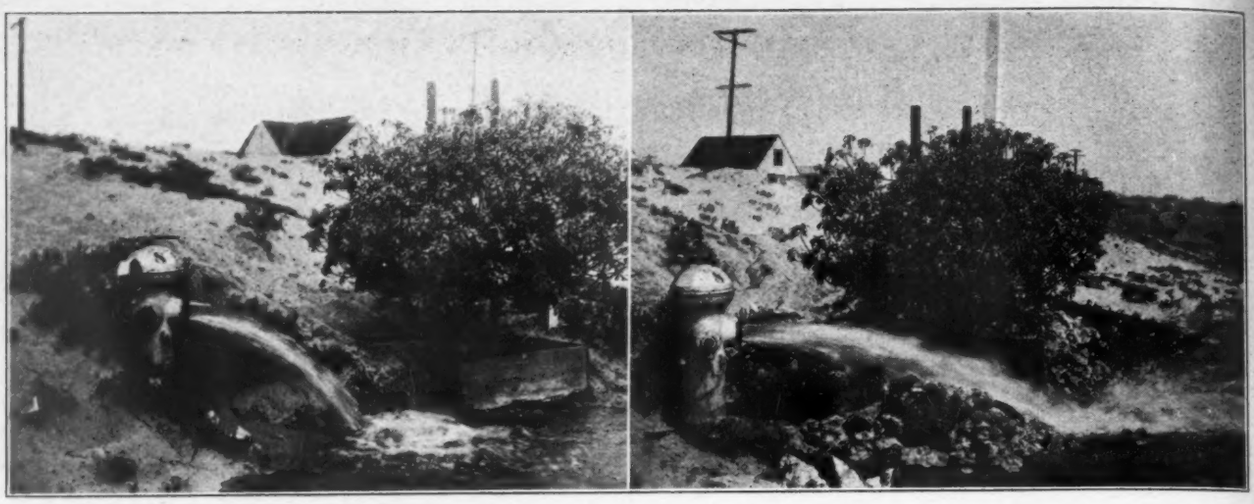
In the particular case these costs would be much more completely segregated. The operating costs would probably be divided as between Production, Distribution, and Commercial—some superintendence going to all three; labor going to the first two; power going to the first. etc., but from the more remote viewpoint of general principles, these details need not be considered.

Under direct operating costs, superintendence includes the salary of the superintendent and such other administrative expenses as may be incurred. Labor and Power include all such items required to operate the system. Clerical and commercial expense includes billing and collecting. Incidental maintenance includes materials for all minor repairs. Miscellaneous includes rents, taxes, and all expenses which cannot be charged anywhere else. These direct operating charges are usually known because they represent actual cash expenditures. Sometimes, however, too much or too little may be included as Incidental Maintenance.

Of the Fixed Charges, bond interest includes the interest for the year on any outstanding indebtedness. Bond retirement is the amount of outstanding indebtedness falling due during the year. Both are definite amounts and have to be met with cash in the publicly-owned utility. It justifies a moment's digression to note that Bond Retirement is not a charge against most privately-owned utilities, because such utilities do not usually pay off their stock indebtedness. Thus a major difference between a privately-owned utility and a publicly-owned utility is, that the latter pays back the money it borrows while the former does not. To the consumer it is the difference between buying a home and renting one.

Depreciation Must Be Recognized

The other Fixed Charge—Depreciation, constitutes an annual expense to the system for wear, not included in incidental maintenance; and for obsolescence. Depreciation is the "abused" fixed charge. Sometimes, many times in fact, in smaller systems it is simply ignored al-



Left: This Hydrant Is On a Long Run of 3-in. Line. At the Right Is the Same Hydrant After a Connection Costing a Few Dollars Had Changed the Feed from a Long Run of 3-in. Line to a Shorter Run of 4-in. Line Which Happened to Be in the Same Street. Adjacent Consumers Benefited by the Increased Pressure

together so far as the records of the system are concerned. But ignoring it in the records, unfortunately does not make it one whit less existent. By way of illustration, let us assume we are to trade in an automobile which is, perhaps, five years old but which has been so well maintained that it actually runs as perfectly as the second-hand dealer will claim when he tries to resell it. If we can get the original price for the old car, or at least the original price with proper adjustment for any change in the price of automobiles since it was new, then truly there is no such thing as depreciation. But, we are offered only $250 when we paid $2,000, and the car runs every bit as well as when it was new. Really that is an insult, but we wind up by taking $275 for the old car and feel that we made a good or a bad bargain—depending upon how badly we have been made to want the new car.

Though it does not follow by direct logic, it is none the less true, that what happens to automobiles happens also to water systems—not quite so swiftly perhaps, but it happens. The pipe line may be kept well cleaned and patched, but try to sell it for what it cost new, or try even to convince the Water Superintendent—when the patching interval becomes short, that it is as good as new.

Therefore, the records which carry the value of the water system year after year as the historical cost, mean nothing at all. Worse than that, they mislead because they build up fictitious values in plant which do not exist and which, when the time of reckoning comes—that is to say, when major replacements are required, will collapse with a resounding thud that should terminate the connections of all who have been previously connected with the water system.

Depreciation must be recognized, and if the true financial status of the water system is to be shown—which is the purpose of keeping records—then the proper annual depreciation charge must appear each year on the records of the utility.

The actual handling of this depreciation charge is another matter. It is dependent upon a matter of fundamental policy to be determined by the administrators of the particular water system. If that policy is, that future replacements are to be made from additional bond issues then the computed depreciation charge is simply a book value to be deducted from the capital value of the plant in order to determine present worth. Consistent with such policy, no actual cash depreciation fund is established. The difference between the annual depreciation amount and the annual bond retirement amount for any given year represents an increment or decrement for that year to the city's equity in plant value, depending upon whether the depreciation amount is less than or greater than the Bond Retirement amount.

If the policy of the administration is that future replacements are to be made from water revenues, then the annual depreciation amount must actually be taken from such revenues and set up in a cash depreciation fund, from which deductions are made from time to time for necessary replacements.

In this case the dispensation of money in the depreciation fund is worthy of considerable thought, if the statement can be made without inferring that the dispensation of money, or the inability to dispense it—for that matter, is not always worthy of thought. A water works system is made up of some items of very long life. Large cast iron pipes may be assumed to have a life of 100 years. To immediately set aside cash at low interest rate to replace a pipe line 100 years hence, is not good business. For this reason, while the proper depreciation amount should nevertheless be set aside, it is good business to borrow from the depreciation fund such amounts as will not be needed for many years, for reinvestment in plant extensions and enlargements—where the borrowed amounts will earn a higher return. This is commonly done in practice. It requires, however, considerable foresight in anticipating replacements, in order not to jeopardize the primary purpose of the depreciation fund.

One word further concerning Depreciation. To actually deduct from the income of the same year for both Bond Retirement and Depreciation is to make payments on two water systems at once. In systems with heavy outstanding indebtedness, this works a considerable hardship on the present contributors to the water fund, and it should not be done. In older more established systems, however, there is usually a major portion of the system which has been constructed from plant earnings and not with borrowed capital. On such portions of the system at least, depreciation can rightfully be deducted from earnings even though at the same time bond retirement payments are being made on other parts of the system. Thus in practice new systems with high indebtedness usually should use the annual depreciation charge as a book value for determining present worth, and older systems with relatively low indebtedness can,

if the administrators desire, establish a cash depreciation fund and make future replacements therefrom.

Thus far we have considered a water system of fixed extent which will need to be replaced in time, but which never secures a new user nor loses an old one. Unfortunately, some request is always being made which requires an extension of a main into new territory or an enlargement of some existing part of the system, and this brings us to the final item in our list of expenses, that is, Extensions and Enlargements. The cost of such improvements are new capital investments in the system and, therefore, add to the capital account and start incurring all of the expenses that accrue to a water system.

Sources of Income

Expenses take care of themselves. They come along without assistance, but we must now consider where the money comes from to pay them, or, perhaps more correctly—where it is supposed to come from. Unlike privately-owned utilities, the publicly-owned system has two sources of income from which to defray these expenses. First, they have taxation—either direct or indirect; and second, water revenues. Direct taxation refers to water taxes appearing as such on the tax bills, being paid, upon collection, directly into the water fund. Indirect taxation includes such payments as those made from the general fund of a city to the water fund and they do not appear on the tax bills as taxes for water purposes. Water Revenues are all those payments made to the water utility by private customers either for water used, for meters installed, or for other service rendered

The proper allocation of expenses as between Taxation and Revenue, that is to say, between property owners and water users, is a matter subject to considerable divergence of opinion. In practice, theory and justice must be tempered to a certain extent by consideration of what the traffic will bear.

In a new water system with heavy outstanding indebtedness and relatively few water users as compared with property owners, more of the expenses must be raised through taxes. Ordinarily, in such cases the Bond Interest and Bond Retirement charges are paid by taxation and only direct operating costs are paid by water users. There is some justification for making property-owners bear the fixed charges of a new water system, psychologically at least, because the enhancement of property values due to the construction of the system is still freshly in mind.

In an old established system with many users and perhaps with little outstanding indebtedness, the allotment can be made more strictly upon some theoretical basis. In many such cases no expenses are raised from taxation, but all are borne by water revenues; and in many municipal systems where a net profit accrues to the utility, excess earnings are turned into the general fund of the city to reduce general taxation.

As a matter of justice, aside from a certain enhancement of real estate values due to the water system, there are certain other expenses, such as the cost of furnishing water for public lands or the cost of establishing and maintaining adequate fire protection, that should not be paid by the water users. The benefits of these services fall to the property-owners on the basis of assessed valuation and they should be paid for by taxation.

Having determined the proper allocation of expense as between taxation and water revenues by tempering local policy with justice, it then becomes necessary to spread those expenses to be borne by the water users in an equitable manner between the various classes of users. Certain of the water system expenses are dependent upon total usage; others are dependent upon the number of consumers; and still others are dependent upon a combination of these. For instance, power depends upon usage; commercial expense depends upon the number of consumers; and labor—at any rate a part of it—depends upon both. Therefore, to determine an equitable rate schedule there must be available a complete segregation of expenses and a complete consumer-breakdown showing just how many consumer-months a year fall in each class. With these data rates which are fair to minimum, average, and large users can be evolved, or the justice of existing rates checked.

Let us admit that in order to properly administer the business of the water system, we need to know the annual operating expenses—properly segregated, and the annual fixed charges including the proper annual allowance for depreciation; to have a fixed policy for handling this depreciation allowance; to anticipate major replacements, enlargements, and extensions; to determine justly which expenses should be borne by taxpayers and which by ratepayers; and finally, in the interest of good will from all consumers, to occasionally check the equity of the rate schedule.

What does this involve? It involves an occasional stock-taking with some expenditure of money therefor. It involves an engineering appraisal from time to time and a general checking-up of the physical condition of the system. It involves the collection of other engineering data. It involves the effort on the part of the administration of lifting itself above a maize of details and of taking a broad prospective view of the water problem. In fact, it involves good business.

The Hydrant (800 *GPM*) *at the Left Is On* 4-*in. Line But Only a Short Distance from a Feed Main. The Hydrant* (150 *GPM*) *at the Right Is On a Long Dead Ended Run of* 4-*in. Line*

ADVERTISING FOR DEGREE OF EFFLUENT

By S. I. ZACK

Sanitary Engineer, The McKenzie Co., Dearborn, Michigan

THE water ways receiving sewage in this country are slowly but progressively becoming more and more polluted due to, growth in population, increase in industrial waste waters, and local accumulations of settled putrescible solids over prolonged periods.

When sewage is discharged in to a receiving body of water it, therefore, sooner or later creates a problem either in the immediate vicinity or elsewhere on the same watershed. Each problem, varying in degree of magnitude, may be classified as nuisances from the standpoint of esthetics, odors, mortality to fish life, injury to live stock and, most important of all, menace to health.

Sewage treatment is the means of minimizing or eliminating the cause resulting in undesirable effects on the receiving body of water.

In determining the degree of treatment, or more particularly the quality of effluent desirable, the potential uses of the stream, whether for recreational, fishing or water supply purposes must receive primary consideration. In each local situation such hydraulic, biologic and physical factors as flow, oxygen resources, velocity, presence of dams, surface turbulence, condition of bottom, temperature, surface area, and distance between points of pollution among other things, determines the residual pollution load that can be left in the effluent from treatment plants without danger of over burdening the natural forces of stream purification. The problem of sewage treatment in each case, therefore, resolves itself into that of providing sufficient sewage treatment to produce an effluent of a quality to preclude creation of a nuisance, unsightly stream conditions or a hazard to health.

Progress, marked by developments in sewage treatment consisting of mechanical equipment and chemical treatment, for use in either biologic or the chemical-mechanical processes, has been made in the past decade.

The quality of effluent obtainable, efficiency of performance and economy of operation may be predetermined by choosing from a variety of equipment, reagents or processes now being offered, on a competitive basis in the open market. The engineer is no longer confined to an application of correct hydraulic and proven biologic principles. Since many of the recent advances have come from industry instead of public enterprise, a municipality may no longer accept responsibility for treatment plant performance but should require satisfactory guarantees from the enterprise deriving the profits. In other words, a municipality is not only entitled to the greatest returns per dollar invested in sewage treatment facilities, but should also be able to benefit by the lowest price for some specified quality of effluent required.

In order to benefit to the full intent of the National Public Works Program, it is essential to get as much work as possible under way at the earliest moment, and to make loans or direct grants on a basis of need and service as well as to afford work relief. Direct grants by the government will be from 25 to 30 per cent of the cost of the project and the balance will be furnished as a loan to be repaid with interest over a period of 25 years. This makes every project of interest to the general taxpayer. The question now arises as to how to put the distribution of money and construction of sewage disposal projects on a strictly business and equitable basis. Shall money be granted to a municipality to install treatment in excess of its needs, thereby denying the needs of another: Or shall it be on a basis of actual requirements in each case? Consideration cannot be given to financing and bond retirement without equal attention to the operation and maintenance charges.

A workable course to follow appears to be that of vesting authority in the organization best qualified and most familiar with the waters and sewage disposal needs in a particular state, namely the State Health Departments or the Stream Control Boards. By adopting practical tolerances of stream loading, for particular streams or for the waters of a state, the above designated authority can then order the various municipalities in the state or on a watershed to provide only the degree of sewage treatment required to preserve the desired stream conditions. Each municipality may then proceed to advertise and take bids for *a specified degree of treatment*. The lowest bid will then serve as the basis on which Public Works Administrator will make the appropriations of the government funds to be allotted as a loan and as a direct grant. It is essential that all bids be supported by suitable bonded guarantees, not only as to results and quality of effluent assured, but also as to cost, efficiency and performance. By such a procedure all moneys will be spent according to a recognized need instead of for projects later to become white elephants or public monuments.

The function of the Consulting Sanitary Engineer is quite evident in this method of procedure outlined. His service will be of value to the public body in working up the various projects and preparing the contract and specifications, segregating the various bids to determine the proposal to be accepted. The Consulting Sanitary Engineer will also be of valuable assistance to the bidder, in the preparation of his proposal and plans. The city may receive bids for construction of a plant at a guaranteed annual cost to give a specified quality of effluent or at a named total annual charge.

This method of handling sewage disposal projects will be timely because:

(1) It makes it possible to allocate loans and grants on the basis of the lowest bidder for individual projects, each of which can be made a part of a state wide program by a recognized state authority.

(2) The municipality is assured of the lowest price to accomplish a required degree of treatment.

(3) It shifts the responsibility of performance of a treatment plant from public to private enterprise. This is particularly desirable at the present time when so much in the way of chemicals and new mechanical equipment is being made available for sewage treatment, and money is furnished from general funds rather than local sources.

(4) It provides a workable and practical means of pooling the combined efforts, experience and knowledge of the Sanitary Engineer with the inventiveness and business acumen of private enterprise, ultimately resulting in the greatest public benefit.

(5) Many states already have laws which provide sewer rental or connection charges for sewage disposal with which to pay for operation and financing of plants. Other states may be induced to pass similar laws and

take advantage of the value of the government grants and repay the loans for the balance.

(6) The Public Works bill paves the way, and sewage disposal projects constitute worthwhile and permanent improvements which provide work relief. By putting the question of actual sewage disposal needs and requirements in the hands of a duly delegated State body and by placing the method of procedure on a strictly business basis it will prevent the public from being exploited by promotional schemes. The money will be well spent without waste in first cost for construction or the highly important operating costs to follow.

Drawbacks of putting such a plan into effect in its entirety are recognized. Some of the State Health and Stream Control authorities may lack powers of enforcement, or have not sufficient technical data at hand regarding its streams to set up state wide standards, thereby making it necessary to rely on arbitrary rulings or regulate individual situations independently. Most important of all is the question as to whether municipalities can be relied on to make ironclad contracts and enforce guarantees.

However the general idea of "Advertising for Degree of Effluent" has considerable merit and is worthy of consideration by cities, states and the professional engineer, as well as industry engaged in the business of sewage disposal. Its application can be modified according to local and state conditions. A cooperation of all the agencies mentioned will result in progress, not only in the art, but also in a greater popular appeal, creation of interest, and finally the best possible method for handling sewage disposal projects based on sound economics.

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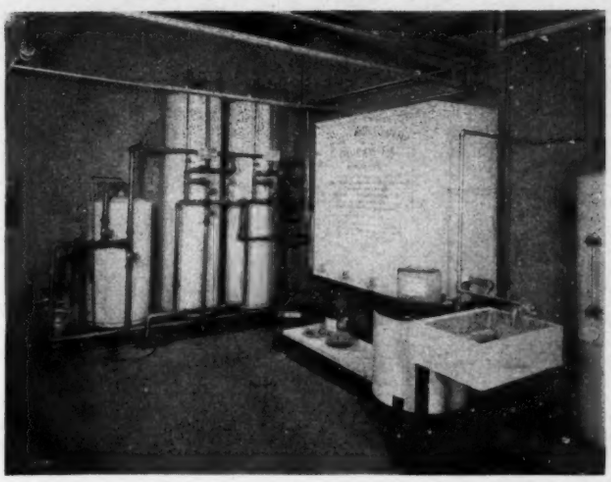
Century of Progress Visitors Drink Super Purified Water

In "A Century of Progress" one meets, on every hand, remarkable scientific developments which will influence living for years to come. One of these is the development which solved the drinking water question. For fire, sewer and general purposes a new pumping station was constructed near 39th St., where booster pumps supply the Chicago city water at 80 to 100 lbs. pressure. For sanitary and health measures this water is heavily chlorinated. There are a number of large, artistically designed circular fountains on the grounds where the public can drink.

In the main exhibit buildings: Hall of Science, General Exhibits, Home Planning, Travel and Transport, Electrical Group, Hall of States, and Agricultural Building, the management of "A Century of Progress" has adopted what is known as the "Groak System of Water Purification."

In this system, the water is coagulated, settled, and filtered through pressure filters. The water continues its flow thence through a filter, which is filled with mixed activated carbon.

After passing through the carbon filter, the water is ozonated. There is a large storage tank with a float valve that controls the amount of water which is used and has to be replaced from the filters. This float valve, when the water is below predetermined level, makes contact through a mercoid switch which opens a water valve from the filters. The same switch starts ozone generators which produce ozone in concentric pyrex glass tubes with silent glow electric discharge from 10,000-volt



Water Purification System at Century of Progress, Chicago

transformers. The ozone removes all remaining bacteria, organic impurities, color or disagreeable odors and tastes.

There are two more compartments on top of this storage tank filled with a compounded material, the base of which is Nuchar. The ozonated water is sprayed over this material. Iron or other impurity that the ozone has precipitated, is removed by this refiltration. Thus the water is super-purified for use by the public. Much of it is then bottled in five-gallon glass containers and delivered during the day and night to exhibitors and concessionaires who have electric or ice coolers on their own locations.

For the public who wish to quench their thirst this same water is provided at numerous stations throughout the grounds. An electric unit pumps the water from the storage tank into a pressure tank automatically as it is being used and through a large brine tank where it is automatically refrigerated to a temperature of from 45 to 50° F. From this point the water is distributed to a series of conveniently located fountains, supplied with Tulip paper drinking cups.

Irwin D. Groak, the Chicago Engineer who designed the Groak System, has spent 18 years in the development of water purification systems and the construction of power plants and pumping stations. Several large buildings, including hotels and hospitals, use the Groak System in one form or another.

The Century of Progress installation involves the use of Graver filters and Nuchar. The ozone generators are of his own design and the plants have been designed in a way to present, in themselves, an instructive exhibition pleasing to the eye.

The quality of water produced is carefully checked by the Chicago City Department of Health.

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Hudson River Pollution Survey Begun

The Division of Sanitation of the New York State Department of Health has begun a survey of the Hudson river to determine the effect of the pollution from the more important sources and the capacity of the river to assimilate such pollution through natural purification agencies.

During August, an intensive investigation will be conducted in the lower Hudson bordering Westchester county. The Westchester County Department of Health will coöperate by making special studies at bathing beaches in this district.

CLAY USED AS ARTIFICIAL TURBIDITY TO ELIMINATE SHORT FILTER RUNS

By CARL LEIPOLD

Superintendent of Filtration, Winnetka, Ill.

SHORT filter runs at the Winnetka water filteration plant was shown to occur between April 15th and October 1st of each year. During this same period, the raw water supply contains abundant miscroscopic plant growths and organisms, with high water temperatures (60 to 84 degrees F.) and low turbidity readings (0 to 10 p.p.m.). The peak rates of pumpages with mixing and coagulation retention periods at their minimum, also occur during this period of short filter runs.

The water filtration plant was designed for a 13 minute mixing retention period (mechanical agitation type of mixing) and a 1 hour and 50 minute coagulation retention period at plant capacity of 3.0 M.G.D. For a period of seven to eight months of the year, the daily total pumpage is between 1.5 and 2.0 M.G. Through the remaining four to five months, or the summer months, the daily total pumpage is between 2 to 5 M.G. with maximum hourly rates of pumpages from 8 to 10 M.G.D. The maximum rates of pumpages are only for a few weeks and to have a water plant of proper design to meet these peak loads for such periods is an expensive proposition.

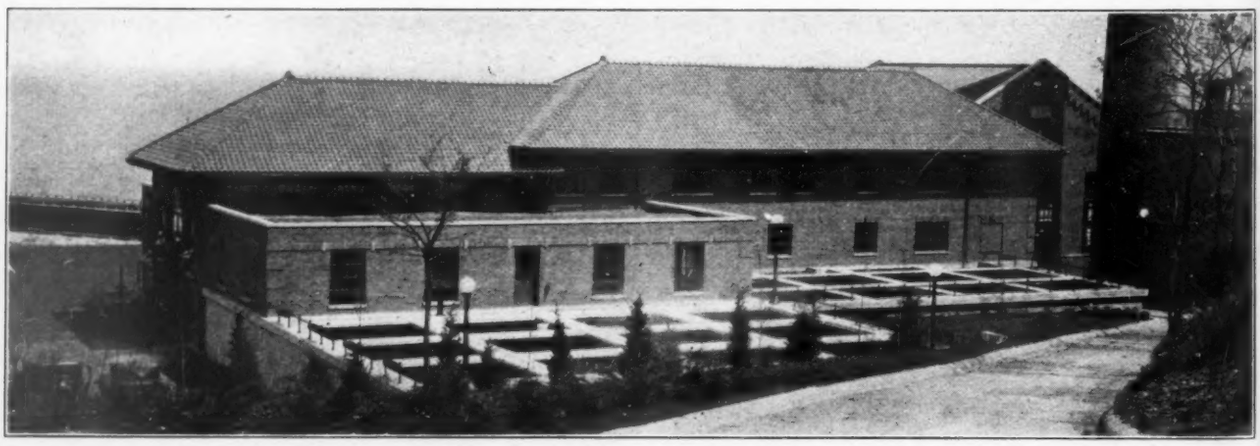
During one year, the filter operations showed the daily average filter runs for the month of May 3 hours, for the month of June was 2.5 hours and for the month of July was 4.75 hours. With 15 minutes taken each time to wash a filter (that is to take out of service, wash and place into service) 5 to 9 hours was lost each day in the operation of the four filters. This lost time for filter washings, plus the 3 to 5 per cent filtered water used for filter washings, caused a decrease in plant capacity of 10 to 14 per cent and some days with average filter runs of 0.9 hour caused a 27 per cent decrease in plant capacity.

Clay Tried

Artificial turbidity treatment using crushed "green" clay bricks was applied for 19 days during the year 1929 and for 100 days during the year 1930, to eliminate the short filter runs. The applied clay serving as nucleus and as added weight for the alum floc, induces better and more rapid settling of the microscopic plant growths and organisms.

The clay used was received from a brick manufacturer. The raw material removed from a pit located at Glenview, Ill., was passed through a granulator machine where crushed hard coal and crushed burnt brick was added to the clay. The crushed hard coal is added to assist in burning thoroughly the green brick. The crushed burnt brick is added to absorb moisture in the clay. This treated clay was passed through 3 separate crushing machines and then put into the pug mill where water was added to the clay and thoroughly mixed making the clay plastic and easy to mould into brick shape. The plastic clay was then passed through the brick cutting machine. These "green" bricks were stacked on steel cars, placed in ovens and dried by primary heat of 4,000 degrees Fahrenheit for 24 hours. The "green" dried bricks were then ground to the proper size by the dry pan machine. The ground clay was shoveled into paper bags, sealed and transported by truck to the water plant. The average weight per bag was approximately 100 lbs. The cost per ton of clay was $7.70 delivered on the water plant storage room floor.

The clay was applied through a dry feed machine which had a dissolving box with the discharge pipe running to the top of the mixing basin. The rates of clay applied during the 100 day period of the year 1930, varied between 1.1 and 7.1 grains per gallon. The results of plant operations during this period, shown in figure No. 1, indicates that for satisfactory and efficient operations with artificial turbidity, it is essential that the mixing retention period be more than 15 minutes and the coagulation retention period be above 2 hours. The alum and clay treatments were eliminated at periods, due to insufficient mixing retention period. It was shown that short filter runs with mud balls forming in the filter sand which caused the filter sand to shrink away from the walls and also form cracks throughout the filter sand bed, would occur when using alum at periods of short mixing and coagulation retention periods.



The Winnetka Filtration Plant on the Shore of Lake Michigan

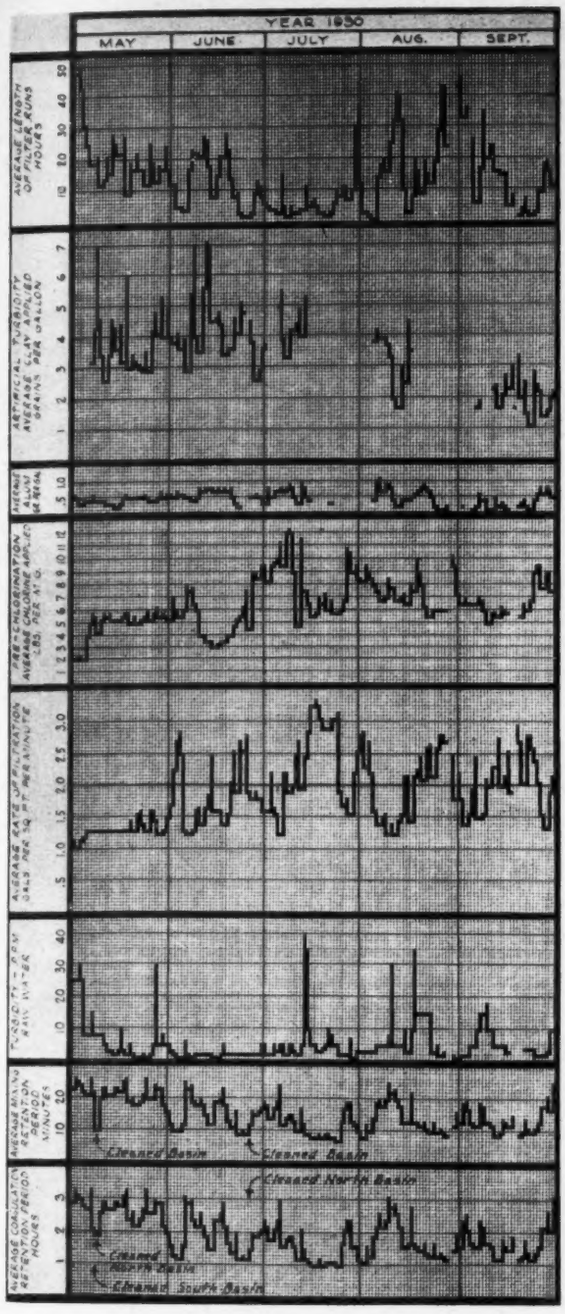


Fig. 1—Plant Operations During Period of Artificial Turbidity Treatment for Year 1930

The crushed "green" clay bricks, proved by application on a plant experimental scale, that settling of the material occurred too fast. In cleaning the mixing basin where the clay was applied, the 10 inch drain pipe became clogged immediately, and necessitated the removal of the head and gate from the drain valve in order to apply proper water pressure and removal of the clay. It required much work and additional time to remove all of the settled clay from the basin. Considerable trouble and expense for repairs to the dry feed machine were caused by applying the clay, probably due to the added crushed coal, crushed burnt brick and variable size.

Efficient operations which we considered would be effective with artificial turbidity treatment are as follows:

1. Settling microscopic plant growths and organisms in the coagulation basins thereby keeping sand clean in the filters.
2. Longer filter runs, which gives larger capacity to water plant by saving lost time for filter washings.
3. Lowering operating costs by less filter washings.
4. Lowering operating costs by using lower rates of alum.
5. A better quality of filter effluent by checking sand from parting away from filter walls and cracks forming in filter sand bed.

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Pennsylvania Sewage Works Association

To Meet at State College in September

On September 5, 6, and 7, the Pennsylvania Sewage Works Association will hold its 7th Annual Conference at State College, Pa. Last year there was some thought given to holding these annual meetings at other points in the state, but the central location, the facilities offered at the Pennsylvania State College with economical housing in the college dormitories, together with the excellent golf course close at hand, makes State College the ideal place to hold such meetings.

TUESDAY NIGHT, SEPT. 5 (7 P. M.)

"Demonstration and Instruction of Sewage Plant Tests"
F. E. Daniels, Harrisburg, Pa.

WEDNESDAY, SEPT. 6

Forenoon: "Trouble Hour Symposium" (in which the following plant operators and superintendents will take part):

A. B. Cameron (Erie); Roy L. Phillips (Meadville); Frank Altemus (Norristown); R. R. Cleland (State College); C. F. Grace (Polk); F. M. Harper (Butler); L. E. Burnside (Sharon); C. S. Boettger (Delaware County).

BUSINESS SESSION

AFTERNOON

"Operating Experiences in New York State"
C. C. Agar, Albany, N. Y.
"Excessive Ground Water in a Sewer System and Its Effect on Sewage Plant Operation"
C. A. Emerson, Jr., New York City, N. Y.
"Application of the Sewer Rental Law"
John L. Fertig, Harrisburg, Pa.
"Experiments Upon the Heating of Sludge to Determine the Heat Transfer Coefficient from a Heating Coil to Sludge"
E. R. Queer, State College, Pa.

EVENING

Annual Dinner—H. E. Moses, Toastmaster
(Round Table Discussion and Entertainment follows the Dinner)

THURSDAY, SEPT. 7

FORENOON

"Sewage Collection and Disposal at Lancaster, Pa."
J. F. Laboon, Pittsburgh, Pa.
"The Oxygen Demand Test and Its Application to Sewage Treatment"
J. K. Hoskins, Cincinnati, Ohio
"The Mechanical Dewatering of Sewage Sludge on Vacuum Filters"
E. D. Flynn, New York, N. Y.
(Adjournment at Noon)

GIVING CONSIDERATION TO SEWER MAINTENANCE DURING DESIGN AND CONSTRUCTION

By EDWARD H. RUEHL

Town Manager,
Bluefield, Virginia

Edward H. Ruehl

ALTHOUGH, in making preliminary surveys and studies and working up designs for a sewer system, a good deal of time and effort are spent on the work there are, sometimes, things that are overlooked, especially as to points in regard to maintenance of the system after its installation. Then again, after the study and design have been completed there are many cases where competent and honest interpretation of the plans and specifications and supervision of construction are regarded too lightly. The result is that the sewer system will not function properly and will give trouble from the start which will cost money to correct and will cause criticism of some public official for letting such conditions creep in.

This article is intended to call attention to just a few—not all by any means—of these things and although some may be considered very simple and commonplace they are extremely important in the continued operation of the sewer system, which is the sole object in constructing it, and careful consideration of these factors during the period of design and construction will save much worry and expense later on.

It would not require much temerity to assert that some of those reading these few suggestions have already had to correct some of the things called attention to.

In sewer inspection work as in any other technical branch, competent men should be employed who know the functions of the various appliances and appurtenances so that the installation thereof will be properly done.

Pipe and Pipe Laying

These remarks pertain mostly to the small sized pipes, usually of glazed sewer tile, but none the less important because this is the kind that is generally installed in the smaller towns which do not, in a good many cases, appreciate the necessity of thorough inspection during construction, feeling that they are unable to afford competent supervision.

In general, good practice dictates that there should be separate systems for sanitary and storm sewage and less trouble will be encountered in maintenance if this is borne in mind from the start, as well as to give due thought to the sizes of the various pipes with regard to future requirements.

It is not good practice to lay sewer and water pipes in the same trench. If this is done maintenance work on a water line is almost certain to cause trouble with the sewer line and the water line is practically always in the way when sewer maintenance is necessary. Difficulty will invariably be encountered in making new connections to either the water or sewer lines if both pipes are laid in the same trench and this situation will likely cause some friction between two departments of the municipality.

Leaks in water mains generally cause underground cavities which might cause settling of the sewer line with resultant trouble if they are in close proximity to one another.

The sanitary aspect is one that should receive no little consideration in this connection as there is danger of polluting the water supply with sewage with perhaps dire results.

Specifications for sewer systems may leave it optional with the contractor as to the length of pipes to be used. Sewer pipe is made in lengths of two, two and one-half and three feet and it is generally better to use either the two or three foot lengths rather than the two and one-half. Most supply houses carry two foot joints in stock and if a break occurs or a new fitting is to be installed three, two foot lengths can be installed in the place of two, three foot lengths if this length was originally installed, but if two and one-half foot lengths were in the system originally, four would have to be removed and five two foot joints installed instead. This would increase the work and expense materially. The writer has had some experience along this line and enough has been said to show that this point is worth considering in drawing up the original specifications.

In the actual laying of the pipe extreme care should be taken to have a solid bearing for the pipe to rest on as sewer systems must be laid on accurate grades which must be maintained through the stage of backfilling and thereafter. Several different methods of providing the foundation are in common use and specifications usually cover this point with due regard for the kind of ground in which the sewer is to be laid. The main point is to see that the pipe is accurately laid on a firm foundation.

The making of the joint is an all important part in the laying of sewer pipe. Too many times do we find sewers where no attempt whatsoever was made to

Mr. Ruehl in this article sets forth some advice in respect to the more commonplace faults found in sewer construction which have a marked influence on maintenance and operation subsequently.

He recites some of the violations of good practice in sewer construction which he as the manager of a small city has had to cope with.

In order to warn others of the defects and shortcomings of sewer design and construction which may cause endless trouble and expense later, he gives the reader the benefits of his observations and experience.

make joints and in others where the joints are very poorly made. Poorly made joints will allow great amounts of ground water and tree roots to enter the system which will invariably cause trouble in one way or another. Too much ground water entering the system during heavy rains will cause overflow of manholes with the sewage scattered over streets and in cases where quantities of water leave the pipe at the joints, due for instance to a different soil structure from that in the vicinity where the water entered the pipe, the supporting area may be washed away and the pipe itself settle, causing considerable aggravation in maintenance. Extraordinary amounts of ground water entering the system also affect the operation of sewage treatment plants.

In making up the joint a quantity of oakum should be put completely around the spigot end of the pipe and forced home in the bell, care being taken to see that the space all around the spigot is of uniform width. After this, cement mortar should be applied and thoroughly tamped into the bell and a fillet should be formed from the outside circumference of the bell to the adjacent pipe.

Each length of pipe should be swabbed carefully after it is laid to see that no cement which may have been forced into the pipe when making the joint will be left therein to produce lips. This detail, considered perhaps trivial, is at the seat of a good many sewer maintenance troubles, especially in the smaller sized pipes and house laterals. Various sewer joint compounds are on the market which make very good joints if used according to the manufacturers' recommendations.

Roots cause a great deal of trouble where they enter poorly constructed joints and the man whose job it is to maintain sewers after they are installed fully appreciates what a great amount of trouble a little effort on the part of the construction forces can save. A very small root not any larger than a piece of string will get itself, by some law of nature, into a minute hole or crack in a joint and when once inside spreads out to fill the entire diameter of the pipe and then continues to grow lengthwise of the pipe. Needless to say this causes maintenance troubles and expense of cleaning.

Too many times where grades demand that the pipe have very little cover, sufficient thought and care is not exercised to put in cast-iron pipe to withstand the loads of traffic.

In blanking off house connections too much care can not be put on the manner of doing it. The type of plug used does not make much difference as long as the opening in the service pipe is fully closed. The writer has taken bricks out of a sewer pipe that apparently entered by the route of an open house connection and has found where storm water from a ditch was allowed to enter one of these connections with the result that sticks and every conceivable kind of debris lodged in the sewer pipe and caused considerable maintenance trouble.

If it is necessary to make branch connections to a line after it is installed the method of so doing should receive careful consideration so as not to have projections inside the pipes and the "cut-in" devices on the market help to overcome the difficulties and troubles usually caused when connections are not properly made.

Back Filling

Strange as it may seem it has happened that money was spent in buying good sewer pipe and laying it accurately and then during the back filling carelessness was allowed to creep in when rocks were allowed to fall on the pipe or the backfilling thrown in carelessly and the sewer, although brand new, gave trouble from the start due to joints being broken or alignment deranged. Inspection at this time is of utmost importance and must be done as the work progresses because it is extremely difficult to detect broken or deranged pipe when once covered up.

Back filling should be done in a very careful manner to a height of at least the center of the pipe. This practice will help prevent the pipe from being dislodged and will give the back fill a chance to get well under and closely around the pipe to give it a good foundation throughout the length of each joint.

Manholes and Lamp Holes

In many cases too few manholes are put in the system; this is mainly due to supposed economy but in the long run is at times very costly. The writer is of the belief that manholes should be located at all intersections of main sewers, at all bends and with an occasional one in between, especially if the run is of any considerable length.

It is extremely important that the bottoms of manholes be carefully constructed and the design should call for channel pieces therein. Further care should be exercised in the construction of manholes to clear away any mortar, brickbats or other matter that may have fallen into the manhole during its construction.

Lamp holes, perhaps, serve their purpose but as they do not cost as much as manholes some designers include them where manholes should actually be placed. The writer has changed a number of lamp holes into manholes where they caused more trouble than they did good. If a lamp hole is installed, good design would call for a cast-iron tee in the main so that any traffic that might come on top of the lamp hole will not break the main pipe. If a regular glazed sewer tile fitting is used in the main it should be re-inforced with concrete to withstand the loads mentioned above.

Lamp holes, due to their small size, are sometimes not discovered when street grading or improving is done (usually carried on by different gangs) with the result that the lamp hole is covered up and a transit has to be resorted to and the map referred to in order to get its location, all of which should be unnecessary.

It is good practice to have the lamp hole top adjustable in design so that it can easily be brought to grade and if this can be done with a minimum of effort there is more likelihood of the street forces making the necessary adjustment.

Careful attention should be given to the location of manhole overflows, both as to location in the system and height in the manhole. It is better to install overflows in manholes to let the contents of sewers out, in case of stoppage at certain places than it is to let the sewage overflow from the tops of several manholes into streets or other places just as undesirable.

Changes and Final Maps

It is rarely possible that a sewer system can be installed exactly as planned; there being certain details which must of necessity be changed slightly. If these changes are made with competent advice the chances are that no trouble will be experienced later on, but rapidly as they are made the information should be recorded carefully in notes and the original plan corrected so that when the entire underground system is completed and out of sight there will be an accurate map of it for future reference. Extra effort in this respect will more than pay for itself even though a competent man must be hired to do the work.

When a new sewer system or extension is put into service rigid exclusion of rain water and connection with down spouts should be exercised.

EDITORIALS

The Business Side of Water Works Management

DO many Superintendents of Water Departments consider their position as being that of a merchant or as heading the Sales Department of a utility? Probably not: but just the same they are merchants.

Miss Elizabeth Symms, Public Relations Counselor of the Indianapolis Water Company, in addressing Water Works Managers and Superintendents during the recent Convention of the American Water Works Association, very effectively stated the relationship between water consumers and the Manager of the Water Works. He must realize, according to Miss Symms, that he is basically a merchant of the highest order with a precious commodity for sale. Further than that, to attain success in management, the Superintendent or Manager had the important job of selling "service" of the 24 hour variety and if he failed in this "he would be faced with dark days ahead."

There was considerable of interest on the program of the recent Convention, relative to what might be termed the business side of water works management. That most valuable of intangible assets to business houses and utilities—"Customer's Good Will"—came in for a deal of attention. The widespread and gaining interest in this phase of utility operation and an increasing appreciation of its value, was evidenced by the large attendance at the sessions in which good-will, public relations and publicity, constituted the topics being discussed. The ensuing open discussion was still more indicative of interest. Evidence was forthcoming from many alert managers to clinch the argument that publicity and good-will building were to be easily proven of value to Water Departments, both from the standpoint of income and satisfactory public relations, which are so important in times such as these when taxpayers are out to curtail expenditures of all sorts—even those which may be vital to the best operation of publicly owned utilities. The old axiom that "a friend in need is a friend indeed" applies in public utility operation now as never before.

A prominent member of the Association and an Engineer, who has responsible charge of a large municipally owned water works, said that he had come to appreciate that time and effort put in on engineering and improving plant efficiencies has been too great in comparison to that devoted to publicity, aimed at creating consumer good-will and a better appreciation of the product and service supplied 1,440 minutes of every day in the year. Expressed differently, this is another way of saying that highly efficient "water-factories" have been constructed and operated but the all important departments to successful enterprise—namely, the "sales and advertising departments"—had been neglected to far too great an extent.

Hand in glove with satisfactory public relations and good-will building goes the handling of complaints and the treatment accorded consumers who have filed complaints. The modern utility, which is privately owned and, therefore, more dependent upon customer good-will and income than are municipally operated utilities, have long since learned the great value of courtesy, diplomacy and *promptness* in responding to customer complaints. Making comparisons (which is usually odious), a member of the Association, who had been connected also with gas and electric companies, reported that he had had opportunity to observe that complaints from water consumers as a rule do not receive the same attention as those received by gas or electric utilities. He explained that he wished to say as much openly, because he had learned that "nothing was more progressive than careful, prompt attention to complaints." On another day H. E. Jordan, in discussing the value of the laboratory personnel in effective complaint handling, even considered the death of a pet gold-fish to be just cause for a polite telephone explanation and a follow up to insure the consumer that his impression that the water "with all those chemicals in it" had not in fact caused the fish mortality and, therefore—and here is the important feature—was not dangerous for human consumption.

Now, we approach dangerous grounds on which to tread—that of proper rates for municipally owned water works and the proper charging of other city departments for water supplied these. In a paper presented on this topic, before the Finance and Accounting Division of the Association, by A. B. McCrum, Secretary of the Public Utilities Association, Charleston, W. Va., it was clearly put that a municipality operating its own water works is morally and legally "in the business of supplying water and is not acting in its governmental capacity in this matter." Therefore, Water Departments should, by legislative acts, be required to operate on a business basis and not on a basis of political expediency which involved, too frequently, a process of juggling of funds without sound reasoning being behind the actions. Mr. McCrum cited two equally unsound conditions found in municipal operation: The first, that of a plant which makes high profits on the water sold for the purpose of "sweetening the pot" of general funds which may or may not be equitably and efficiently used. The second, that of a plant offering cheap water (usually as a political expedient) and thereby having to draw operating charges, in part, from the general tax funds. Either scheme is basically unsound, wrong and unfair. He correctly sets forth the contention that a municipal utility should operate on a 100 per cent self supporting basis, with a contingent or reserve fund created from earnings to meet its future needs: Nothing more—nothing less would prove fair to all concerned.

What Miss Symms has done for the Indianapolis Water Company and what the late Roy Champion has done for Holland, others can do elsewhere. Politics have no place in Water Works operations. The sooner out, the better for the self respect of conscientious and diligent Water Works officials.

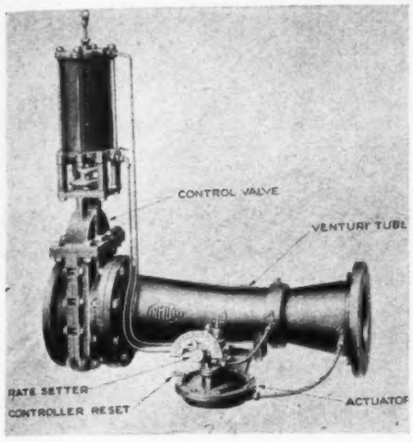
The President and the N. R. A. would do a lasting deed for the good of Water Works employees and cities at large, if they should insist on the drafting of a "Code for Municipally Operated Utilities," or else require cities to adopt and *live up to* the Codes being prepared for privately owned utilities, including that for Water Companies.

L. H. Enslow.

NEW EQUIPMENT AND MATERIALS

International Filter Co. Announces Infilco Type CD Rate of Flow Controllers

International Filter Co. has added an improved type of controller to its line of hydraulic control equipment. The CD Rate of Flow Controllers are designed for any waterworks or industrial plant requirement where automatic maintenance of a uniform



Infilco Type CD Rate of Flow Controller

rate of flow of fluid is either desirable or necessary for efficient operation.

The maintenance of a constant differential across the actuator diaphragm at equilibrium position, no matter at what rate the controller is set, is the ingenious operating principle from which the CD controller takes its name. This principle permits placing all the actual controlling elements inside the actuator casing and eliminates stuffing boxes, pivoted levers and movable counterweights from both the line of automatic control and released power.

Operating rates for the type CD controller are changed simply by turning a knob and moving a pointer to the rate indicated on a calibrated rate setting dial. These controllers are provided with a reset to automatically close the control valve when flow through the line is shut off. Thus, when flow begins, the controller regulates "up to" rather than "down to" the set rate of flow and the normal operating rate cannot be exceeded even momentarily while the shut-off valve is being opened.

The type CD wash water controller is equipped with a patented automatic feature that regulates the movement and position of the control valve when a wash water valve is closed. The control gate or vanes are automatically brought to a point of closure somewhat under the normal open position and are held there by the operating mechanism and the valve stop until the wash water valve is fully opened. This device automatically prevents waste as well as dangerous wash rates in filter plant operation.

There is but one simple adjustment to make at any time after installation of the CD controller, namely, adjustment for the zero or equilibrium position of the diaphragm and the control pilot. Positive adjustment can be made with a wrench and screwdriver in but a few minutes' time by anyone. Skilled attention is never required. Simplicity of operation and exceptionally rugged construction of the CD controller assure continuous operation without annoying adjustments or repairs.

Loss of head through the standard controllers is but a fraction of a foot at normal flow, an important advantage in filter plant operation.

These controllers are shipped completely assembled and installation merely consists of setting the controller in the line and making pressure and waste connections to the control pilot.

International Filter Co., 59 E. Van Buren, St., Chicago, Ill., has just issued a 16-page illustrated bulletin, No. 67, describing this constant differential type rate of flow controller which can be had for the asking.

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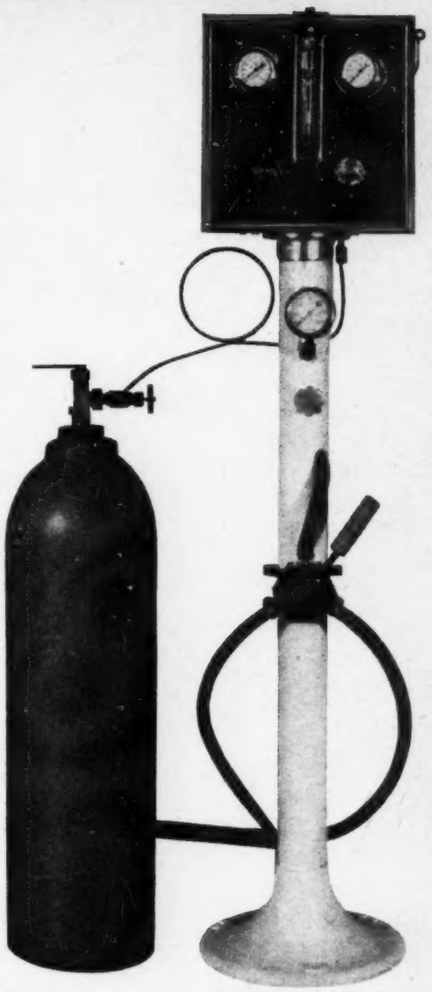
Filclor Builds Chlorinators and Ammoniators

The Filclor Company of Philadelphia, Pa., announces their entry into the chlorinator and ammoniation field. Both direct and solution feed chlorinators are being offered and one of the features is the gas cleansing device (Filclor purifier) known to the trade as "Filclorator," which constitutes an integral part of the chlorinator and through which the chlorine passes before reaching small orifices of any kind. This cleaner is employed to preclude clogging of the small passages and the diffuser with impurities which chlorine sometimes carries in solution and which are carried over with the gas to the chlorinator. The diffuser used on direct feed machines is of a special design. The ammoniator diffuser is of stainless steel.

The solution type chlorinator is served by an injector operated from water pressure lines in the customary manner. The chlorine gas enters a chamber under vacuum just prior to going to the injector where the chlorine is dissolved before entering the water, etc.

The manufacturers make the following claims for the Filclor Chlorinator: Simplicity; fewer parts involved than on any comparable chlorinator; gas cleansing to preclude clogging—an important improvement; rugged construction, utilizing standard and interchangeable parts; handsome finish, utilizing chromium plated parts and fittings; accuracy of adjustments; accessibility of parts. The direct and solution feed types are convertible one into the other.

The Filclor Company announce that the products they offer are manufactured in their own plant and that they have been



Filclor Chlorinator (Type A, Capacity—300 lb. per Day. Type AB, Capacity—0.05-5 lb. per Day)

servicing and repairing existing installations of other manufacturers, not confining this work to their own equipment. This will be an important part of their program, and will be simplified in that their service facilities have already been provided.

Filclor equipment carries a guarantee against imperfections or defects and will be repaired and serviced without cost during the first year after installation.

The Filclor Company is located at 59th and Woodland Ave., Philadelphia, Pa.

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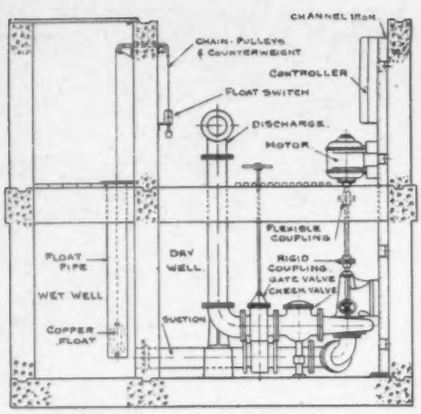
Jeffery Centrifugal Pump Mounting

Yoeman Brothers Company of Chicago, believing vertical pump shaft alignment to be a shop job (not a field job with difficulties involved in avoiding misalignment and the requirement of time, labor and money), they now offer the Jeffery Centrifugal Pump Mounting. The assembly comprises a Yoeman double Timken roller bearing pump and standard motor with ball bearings for vertical operation. Pump, motor and controller all being mounted on



Jeffery Pump Mounting

a heavy channel-iron base at the factory, this assembly may be lowered into the pit and bolted to the wall or beams as is.

Some of the advantages gained from this style of mounting are: The pump pit can be made considerably smaller; no heavy upper floor is required for motor mounting and therefore inexpensive gratings may be used instead of solid floors; vibration is eliminated by rigid bearing supports and through the proper alignment of shaft made at the factory; higher shaft speeds are feasible, resulting in less costly motors being acceptable; accessibility of working parts, valves, etc., and no assembling of parts on the job.

Yoeman Brothers Company, 1433 Dayton St., Chicago, have just recently issued a booklet describing and illustrating the Jeffery Pump Mounting.

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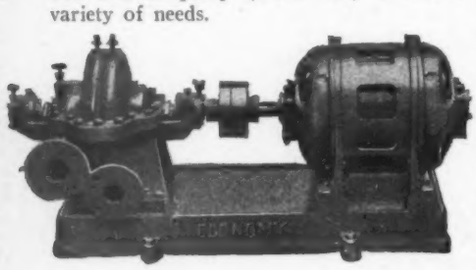
Economy Type DMD Centrifugal Pump

This two-stage opposed impeller pump, offered by Economy Pumping Machinery Co. of Chicago, is of modern design suitable for all clear water purposes where pressures up to 150 pounds are required. Capacities range up to 350 G. P. M., and this size of pump (3x2.5 ins.) fulfills a variety of needs.



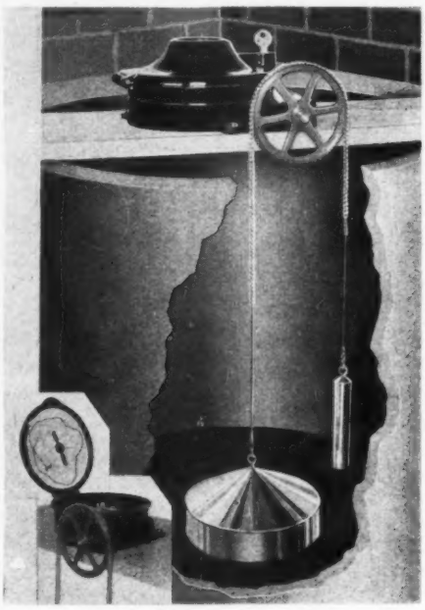
Economy Type DMD Centrifugal Pump.

The design is such that efficiency is well maintained and dependability is assured. Ball bearing construction is used. The opposed impeller design (impellers mounted "back to back") gives hydraulic balance without the use of auxiliary devices. This design enables the use of a short stubby shaft which is extremely rigid, resulting in increased life of packing rigs together with the additional advantage of small floor space.

For further information address the Economy Pumping Machinery Co., 3431 W. 48th Place, Chicago.

Ingenious Water Level and Flow Recorder

The Service Recorder Company of Cleveland, O., who for years have been making similar instruments, have developed a recording device which makes a record of water level or liquid level of any kind. Being comparatively inexpensive, it should be especially interesting to water works men and sanitary engineers. The illustration shows clearly how it operates. It is merely placed directly over a tank, manhole, weir chamber, etc., and a copper float is lowered into same, while a weight on a chain operates the sprocket which, through gears, actuates a stylus which makes the record.



Service Water Level Recorder (Chart Position Shown in Inset)

The recorder is compact and inexpensive, yet has a range of as much as 16 feet head differential. [We saw one of these just the other day at the sewage treatment plant at Newark, New York, which was designed by Mr. Glenn Holmes of Syracuse.] An interesting feature, by the way, is the chart used. This is made of paper covered with wax and the stylus is a sapphire point which scratches off the wax revealing a fine line in brilliant red color beneath. Neither pencil nor ink are required and the chart record cannot be tampered with. One can think of many possible applications of such a recorder—from that of recording the opening of by-pass gates, to that of recording the number of sewage plant syphon discharges or the frequency of other operations.

The recorder, complete, weighs approximately six pounds. By means of two or three different sprocket wheels various ranges can be obtained, so that in most cases the ideal range can be secured merely by use of a certain sprocket wheel. The standard model contains a 3-day clock and chart. Where required, the chart can be left on for 7 or 8 days.

For additional information or descriptive literature, write The Service Recorder Company, 468 Hanna Building, Cleveland, Ohio.

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"Ferrisul," a New Coagulant

"Ferrisul" is the trade name for a new material recently offered as a coagulant for water, sewage or industrial wastes. As the name implies it is the ferric-sulphate of iron and is supplied in anhydrous form for use in dry feeding machines. It is available in "granular" or "ground" form—the former being free from any likelihood of caking in storage bins or the feeder hoppers.

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S. L. Tolman Joins Jeffrey Company

The Jeffrey Manufacturing Company of Columbus, O., announce that S. L. Tolman has joined the engineering staff of its Sanitary Division. Mr. Tolman for the past thirteen years has served the Sanitary District of Chicago and was Engineer in Charge of the Northside Activated Sludge Plant of the Chicago Sanitary District ever since it was placed in operation three years ago, to treat 200 million gallons of sewage per day. He had, prior to that, served in connection with the design and operation of various sewage treatment plants in the Chicago district.

Mr. Tolman was graduated as a Sanitary Engineer from the Massachusetts Institute of Technology in 1915 and at one time was Superintendent of Sewers and Sewage Disposal at Mason City, Iowa. He served in the Sanitary Corps of the U. S. Army during the World War and later designed a system of Sanitary Sewers for Allentown, Pa. Mr. Tolman brings with him, therefore, considerable experience of value to the Jeffrey Manufacturing Company who are manufacturers of sewage treatment plant equipment.

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R. W. Sparling of Los Angeles, Calif., manufacturer of Main-Line Sparling Meters, announces the opening of Eastern offices at 101 Park Ave., New York City, where main-line water meters, service and engineering counsel will be available on short notice. Headquarters of the company are at 945 No. Main St., Los Angeles, and another branch office is located at 3019 So. Michigan Ave., Chicago, Ill.

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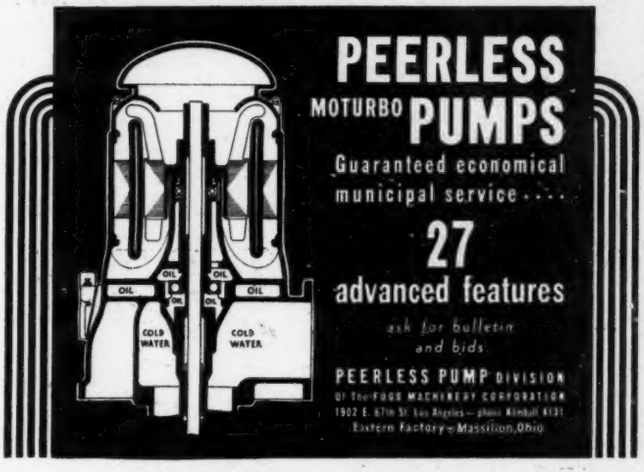

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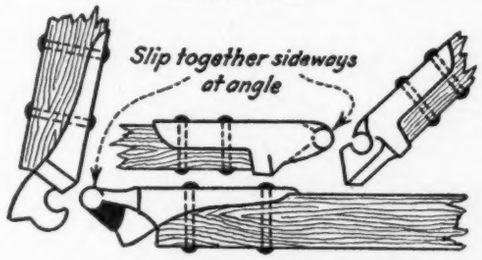

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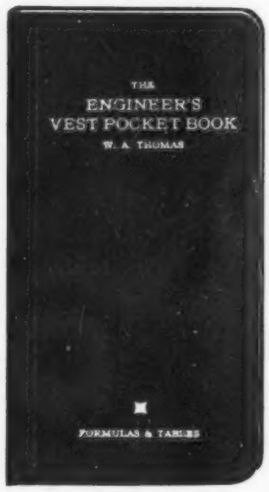

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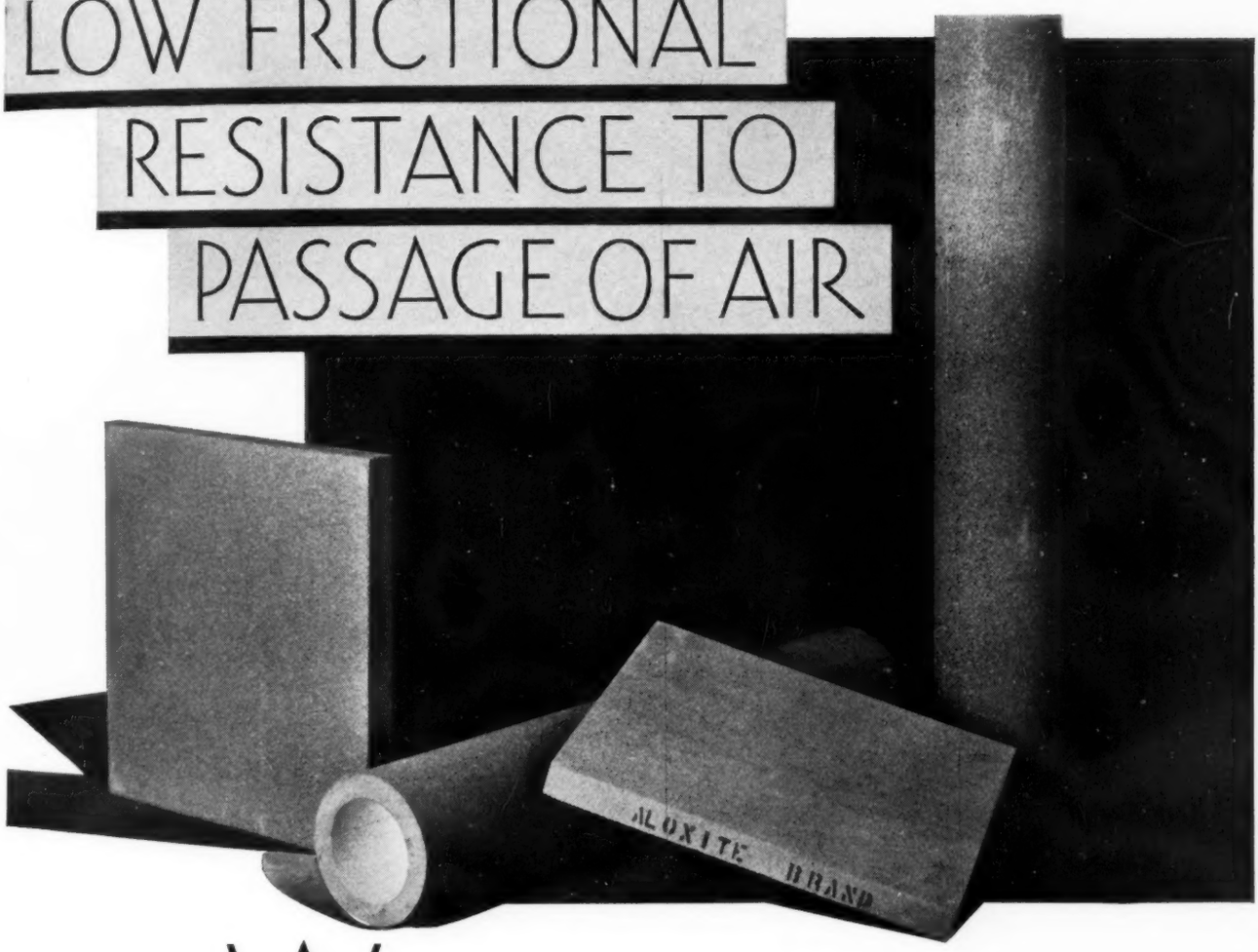

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